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The Cantor Lectures. IT gives us great pleasure to publish in the present issue the first part of Prof. S. P. Thompson's interesting lectures on the electro-magnet. His discussion of the subject is most thorough, and is especially rich in those historical studies and references that render it of great value to the thoughtful investigator. The subject is a most practical one and the name of the author is a sufficient guarantee of the straightforward and clear method of treatment. It is especially gratifying to us to have these lectures turned over to us for publication quite unsolicited, like the important papers by Herzog and Stark recently given in our pages. Time was, within a very few years, when the leading foreign electricians were quite indifferent to the American presentation of their work, and it is most gratifying to us to see not only that they now realize the importance of American publication, but naturally turn to THE ELECTRICAL WORLD as the recognized medium of communication with their scientific brethren on this side of the Atlantic. That such should be the case is a marked compliment to the American public and to this journal.

The Business Still Growing. THE rapid progress and development of the electrical business will be best appreciated by those who will compare one electric light convention with another. Never before has THE ELECTRICAL WORLD found it necessary to devote so much space as it does this time to the report of a summer meeting of the National Electric Light Association. In 1888, and in 1889 as well, 24 pages of reading matter sufficed for the number containing the report of the summer convention. To-day there are no fewer than 32 pages, an increase of 33⅓ per cent. Of advertising pages, there were 44 in 1888 and 52 in 1889; to-day there are 66, an increase over 1888 of 50 per cent. and over 1889 of 27 per cent. In fact, the present issue of THE ELECTRICAL WORLD, consisting, all told, of 98 pages, is the largest number of an electrical journal that has ever been issued in this or any other country. Once more, and in the month of August, the paper breaks its own unapproached record, and demonstrates to the world the wonderful activity among the electrical industries of America that makes possible such a periodical and such a record-breaking number.

A General Electrical Society. IN view of the regular and successful meetings at the Electric Light Convention and the Telephone Convention, one instinctively asks whether it would not be an excellent thing for the electrical fraternity at large to organize for an annual gathering to discuss topics of mutual interest, to listen to reports of progress and improvement, and to arrange concerted action to advance their common cause. That such a meeting could be made successful and profitable is sufficiently attested by the experience of the American Association for the Advancement of Science, the members of which are far less closely allied than the representatives of the great electrical industries. There is no general electrical society in which light and power men, telegraph and telephone experts, manufacturers of electrical machinery and supplies, and engineers in every branch of electrical work can meet in friendly intercourse. It would be of use to them all to meet now and then and learn of the experience, difficulties and needs of every branch of the art. There is nothing impracticable in the idea. The meetings might become unwieldly in size, but that difficulty could be met, as it is now in other associations, by special section meetings. A North American Electrical Association could do magnificent work in advancing every interest of electricians and would serve as the very van-guard in the march of modern progress.

A Note on the Convention. THE twelfth convention of the National Electric Light Association may well be counted as a success. A summer meeting can hardly be expected to gather as large and active an audience as would collect in winter, and yet the attendance at Cape May was very satisfactory. Not so many papers were presented as usual, but their quality was such as to make this feature of the meeting well up to the usual standard. The most important work done aside from this was the marking out of a strong executive policy that will be of great importance to the future welfare of the members. The nature of the association is such that the business consultations and the executive work intrusted to the various committees are most useful. It seemed at one time as if this body was to serve as the nucleus for the gathering of strong representations from all the electrical industries, but the exigencies of the common welfare of the members have demanded a more limited and concentrated plan of operations. The association is doing important work in uniting central station men in a compact and powerful organization that cannot fail to influence favorably the growth of electric lighting and to put its commercial relations on a firm and permanent basis. A full account of the proceedings of the convention will be found in this issue, and speaks for itself of the value of what was accomplished.

Triple Expansion Engines. THERE was general regret at the convention that Mr. Williams did not give a more exhaustive discussion of the use of triple expansion engines for central station work. He is well known as a most skillful mechanical engineer, and thoroughly conversant with the subject on which he spoke. As engine building has gradually improved, the principle of multiple expansion has been introduced with excellent effect. The compound is gradually driving out the simple engine, and it looks very much as if the compound must eventually give way to the triple expansion form. Of course, a time must come when increasing complexity and cost will more than overbalance the saving in fuel; but Mr. Williams made it very evident that in most locations that point has not yet been reached. In situations where fuel is very cheap indeed, as when sawdust and slabs can be burned, a culm pile is close at hand, or natural gas is available, compounding is a questionable advantage from the economic standpoint. But where fuel is dear the reverse is the case, and, as Mr. Williams shows, a triple expansion engine may pay for its extra first cost by its savings for a single year. In the matter of care required and in close regulation it leaves little to be desired. A point particularly worth remembering is that compound engines bear extreme variations of load with comparatively little loss of economy, and as such variations very often occur in central stations, the simple engine is at an additional disadvantage in the comparison. Central station practice should certainly tend in the direction indicated in the paper mentioned.

Concerning Motors. FROM a scientific point of view, the most important paper read at the convention was the admirable study of Mr. Lufkin. Its real value was hardly suggested by its title, which savored of bookkeeping rather than electrical engineering. Nevertheless, we have in it a most valuable addition to our knowledge of the conditions of every-day commercial work. Most people have a very inadequate idea of the amount of power that is actually required to run light machinery, such as saws, lathes, planers, blowers, and the like. In fact, even those most immediately connected with motor installation usually proceed on general principles rather than the experience derived from measurements. To such Mr. Lufkin's study will be of great service, for he gives twenty-nine diagrams of the varying load for a full day's work, taken from all sorts of industrial establishments. Very little information of this kind has been published hitherto, and it therefore possesses an almost unique value. Glancing over the diagrams and accompanying data, the first thing that strikes one is that in most cases the motors are very decidedly under-loaded. In only two cases out of the 29 was the motor at any time overloaded, while the average load was considerably below the rated capacity. On the general mean of all the diagrams it becomes evident that the average output is only a little more than 40 per cent. of the rated horse power. This shows a good chance for improved economy in cost of both installation and operation, for the use of a motor of twice the horse power needed means a higher price and lowered efficiency. Most of the motors now on the market will work safely fully up to their nominal capacity, so that there is no occasion for running them at half load. Another important lesson to be learned from Mr. Lufkin's tables is the great waste of power in shafting. In most of the cases shown, the power thus consumed amounted to something like three-quarters of the mean output. Take for example diagram No. 14. The average power absorbed is here less than 4 h. p., of which nearly three are taken up by the shafting. Of course, sometimes shafting cannot well be avoided, but frequently a little judicious subdivision of power would more than save the extra expense in installation. Mr. Lufkin's proposition, that the charges for power should be based on the maximum load required, seems to us eminently fair. In the early days of motive service, power was charged for at the nominal power of the motors, but at different rates, according to the kind of service. Eventually, perhaps, electrical energy of all kinds will be metered at a definite rate per kilowatt-hour, but until that time comes, charging on the basis of maximum output is fair enough to all parties concerned, and we are pleased to learn that the method is even now coming into considerable use.

Municipal Lighting. A CERTAIN type of being loves to prattle confidently of the marvels of science and more especially of the uncertainties of theory. To its benign influence we would commend the devotees of the "dismal science"—sometimes called political economy—who dabble in electric lighting matters. In theory there is much that is altogether lovely and excellent in government control of industries, but it is melancholy to contemplate the awful chasm that yawns between the theoretical hopes and the practical realization. The discussion on municipal lighting, that has attracted considerable attention during the present year, is a case in point. It had its origin in what we must charitably suppose was a hastily prepared and half-baked thesis, based on the old newspaper and town record file that supplies so much raw material for economic "researches." The alleged facts regarding municipal lighting were scattered broadcast over the country, and have done no little harm to electric lighting interests They are a fair sample of the kind of statistics that is generally culled by one who is densely ignorant of the subject of inquiry. The whole electrical fraternity is under obligations to Mr. M. J. Francisco for the care and labor he has spent in investigating the cases of supposed great economy, and showing the fallacy of any argument derived from them. A practical central station man has a very keen scent for the details of the expense account, and when he finds that an arc plant has run an entire year without any attendance whatever, and without consuming any carbons, he naturally concludes that there is something peculiar—very peculiar—about its management. The figures given in Mr. Francisco's paper are specially valuable, as in many cases they not only show the real expense of city lighting to be considerably greater than if it were done by a private corporation, but they also explain just how the accounts were juggled with, and why municipal lighting does not pay. It is well worth the while for any central station man to take this paper and deliberately compare the municipal operations with his own expense account. Roughly speaking, municipal lighting is usually found uneconomical in two particulars—general loose management and high cost of labor. A political appointee, however honest, does not have the same incentive to strict and careful administration as if his position depended on his personal care and efficiency. The largest single item in the expenses of an electric light station is the labor, and when that is secured to work during city hours at city wages great economy cannot be expected. It is not, of course, impossible for a city plant to be successfully and cheaply operated, but there are very few such cases in actual existence. Mr. Francisco's investigation has thrown a flood of light on the subject, and, making every allowance for occasional misinformation in details, he certainly has established his general position on a very firm basis.

SOME PROMINENT MEMBERS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

John A. Seely, Member Exec. Com.
Dr. A. F. Mason, Member Exec. Com.
C. R. Huntley,
James English, Member Exec. Com.
E. A. Maher, First Vice-President.
M. J. Perry, President.
C. H. Wilmerding, Member Exec. Com.
J. E. Lockwood,
M. J. Francisco, Member Exec. Com.
E. R. Weeks, Member Exec. Com.
A. R. Foote, Secretary and Treasurer.

The Twelfth Convention of the National Electric Light Association.

The headquarters of the association, at Stockton Hotel, Cape May, gradually filled during the Sunday and Monday of last week with a throng of migrating electricians awaiting the opening of the convention. By Monday evening nearly 200 were on the ground and whiled away the time with preliminary festivities of various sorts until Tuesday morning, August 19, when at half-past ten President Marsden J. Perry called the convention to order and presented a very neat and appropriate address of welcome. The regular business of the association was then taken up, and as a preliminary the Secretary announced the appointment of a Committee on Credentials and recommended that an additional Committee on Resolutions should be appointed to deal especially with such matter as might be referred to them, and with proposed subjects for discussion. On motion, the chair appointed Messrs. A. F. Mason, C. R. Huntley and C. H. Wilmerding to constitute this committee; and after these preliminaries the real work of the meeting opened with a paper on "Electrical Industries and the World's Columbian Fair," by John P. Barrett, of Chicago. It was a thoughtful discussion of the electrical possibilities of the Exposition, in view of the present state of the art and what has been previously done in similar cases. Mr. Barrett particularly pointed out the important part that electric power would probably play in the coming exposition. The paper was enthusiastically received, and Mr. Faben, after calling attention to the great interest of the electrical fraternity in the subject, introduced a resolution for the appointment of a committee of five, of which the president should be an ex-officio one, to meet the management of the Columbian Exposition and assure them of the hearty co-operation of the association, and also to recommend the appointment of Mr. Barrett as director of the electrical section. As to the first part of this resolution the meeting was evidently unanimous, but the endorsement of any single person, however meritorious, by the association as a body, was considered somewhat doubtful policy, and after a brief debate the resolution was referred to the committee just appointed, to be reported on later.

Next in order was a report of the Committee on the Copper Tariff, and Mr. Brown, its chairman, reported that measures had been actively taken to agitate the subject of a reduction of the present duties, but that unfortunately in the present state of tariff legislation it was hard to arrive at any definite results. The committee was continued.

Rather late in the afternoon the second session opened with a brief talk on Liquid Insulation, by David Brooks, of Philadelphia, one of the old timers in telegraph work. Mr. Brooks' remarks especially dealt with the danger to which underground conductors are subjected by high voltages.

Mr. P. H. Alexander then read an exceedingly interesting paper by Pr f. Henry Morton on "The Dangers of Electr city." The author drew attention to the fact that as every new power is introduced to the public, it is opposed on the score of safety, and only after considerable time are the proper precautions for dealing with it understood. Such has been the history of the stationary steam engine and of the ocomotive, of gas and of dynamite, so that the opposition in the early days of electric lighting was not without a historical precedent.

Apropos of the same subject, the Committee on Insurance Rules then reported, through George Cutter, its chairman. Not much progress had been made. A circular letter had been sent to various companies, requesting representatives to confer with the committee and aid in the arrangement of rules, and a considerable number of gentlemen had gathered to discuss matter. Several days previous to the opening of the convention had been spent in examining the details of the subject, and, although nothing definite had resulted, a sub-committee had been appointed which it was hoped would be able to report so that the Committee on Insurance Rules could come to some definite conclusion at the next convention, and could present a general set of rules which would be acceptable both to the electric light men and to the insurance companies. It was moved and carried that the report should be received and the committee continued.

Then a discussion on the classification of incandescent lamps, announced the previous day, was called for and was opened by Dr. Louis Bell, editor of THE ELECTRICAL WORLD. The speaker raised a point that our present classification of lamps by candle power is highly unsatisfactory, both on account of the difficulty of determining candle power and the lack of uniformity in lamps of the same nominal capacity. It was high time, especially in view of the increasing extent of which electricity is metered, that the subject should be put on a definite basis so that there should be a standard, for example, for 16 c. p. lamps. The case of arc lamps was even worse, but was perhaps too complicated to be dealt with easily. In any event, the National Electric Light Association was the proper body to take the matter in hand, and it was in every way desirable that some steps should be taken toward putting the whole question on a scientific and definite basis. Perhaps the practice in this country would finally come to classification by watts. It was then moved by Mr. Garratt that a committee be appointed by the chair to report to the next convention a provisional classification. The motion was carried, and the president subsequently appointed A. V. Garratt, Dr. Louis Bell and P. H. Alexander as such committee. The meeting then adjourned, to meet the ensuing morning at 10 o'clock.

First on the order of business Wednesday was a report of the Committee on Patent Legislation. Little had been done, and the committee was discharged. Then Mr. Wilmerding read the report of the National Committee on Legislation. The progress made had not been altogether satisfactory, though a large amount of facts had been accumulated, and legislation had been watched with the greatest care. The committee felt strongly the unfortunate effect of the recent electrical execution, and expressed the opinion that the law should be repealed on the score of humanity, if no other. The principal work done had been the introduction of a bill into the United States' Senate for a better investigation of the electrical industries in the present census.

Mr. G. S. Bowen, first president of the association, was in the hall, and was at this point escorted to the platform. He delivered a brief but very interesting address, speaking of the early history and steady growth of activity and good-fellowship that had taken place during the six years of the life of the association, and spoke with the greatest enthusiasm of the immense possibilities of future usefulness that lie before the association and the electrical fraternity at large. At the conclusion of Mr. Bowen's remarks the Executive Committee recommended that he be elected an honorary member, which was carried with great applause.

Mr. Francisco then took the floor with his elaborate paper on "Municipal Lighting." The author has devoted a very large amount of time to the consideration of the subject and has taken great pains to investigate the conditions that govern lighting by municipalities in almost every case in which experiments have been tried. He showed very clearly that in most cases the result had been most unsatisfactory from an economical point of view, and that while the official reports usually showed cheap lighting, it was in nearly every case shown by investigation that the apparent cheapness was due to the manner of keeping accounts whereby the expenses actually charged to the electric lighting department were only a comparatively small fraction of those that were actually incurred. The juggling with the books had produced a very false impression on the public mind concerning the question of municipal lighting, and Mr. Francisco felt it to be a great injustice to the electrical fraternity that the incorrect statements often made should be allowed to go uncontradicted. From every point of view he regarded municipal lighting as uneconomical and objectionable. As might have been expected the discussion on Mr. Francisco's paper was prolonged and lively. There was a strong feeling among the members of the association that the position taken by the author was correct in every particular. Mr. DeCamp moved that Mr. Francisco's paper be published by the association and distributed broadcast throughout the country, and the suggestion was warmly indorsed by other members. It was finally carried.

Then the Committee on Resolutions, to which the question of a committee on the Columbian Exposition had been referred, reported favoring the appointment of a committee, but sent the clause indorsing Prof. Barrett personally back to the association for its united action. The report of the committee was adopted, and the proposition indorsing Prof. Barrett was, after a sharp discussion, laid on the table, as it seemed to be the sense of the convention that, however great confidence they might feel in the gentleman in question, it was an unwise proceeding for the National Electric Light Association as a body to make personal recommendations which it had not the power to carry out.

The convention then adjourned until the afternoon, when the first paper was read by Mr. DeCamp on "Care and Labor in Electric Light Stations and its Value." A vigorous discussion followed, which Mr. Wilmerding, of Chicago, whose experience was with a somewhat less conservative community than Mr. DeCamp's, took an important part.

Next in order was the paper by Mr. Lufkin on "The Proper Basis or Determining Electric Motor Rates." This proved to be of great value, inasmuch as it gave not only a discussion of the subject in hand, but valuable data showing the exact amount of power required to operate various small manufacturing establishments equipped with many different sorts of machinery. Following Mr. Lufkin's paper were two dealing with the generation of power by steam engines—the first by Mr. H. M. Swetland, editor of *Power-Steam*, and the second by Mr. Williams, of Beloit, a well known engine builder. Mr. Swetland's paper dealt particularly with the necessity of a careful study of the conditions of economy which were generally rather imperfectly known and the necessity of collecting data on the subject so as to establish clear ideas of what economy can be expected and the greatest saving that can be accomplished. The discussion on this was deferred until Mr. Williams had read his paper on the use of triple expansion engines in central station work. He favored this proposition on the ground of economy, and showed that while, as stated, the triple expansion engine costs 20 per cent. more than the ordinary compound engine, the saving in fuel is so great that in many cases the extra cost will be paid for by the decrease in the first year's coal bills. Mr. Garratt moved to instruct the Committee on Data to report specially on the cost of power and central station work in this country. His proposition was at once carried, and the Committee on Revision of the Constitution then reported through Mr. Francisco. As the hour was late, it was moved that the report be received and taken up as a special order of business next morning. The meeting then adjourned.

At the appointed time the association met, and this important business was taken up. It was very evident that the discussion would be active. The principal point involved in the proposed revision was the limitation of the privileges of associate members. At the present time active membership of the National Electric Light Association is confined to those persons who are directly engaged in central station work. The associate members, representing other phases of electrical industry, did not have the right to vote, but received the privilege of the floor, and of attendance at all meetings of the association. The report brought in by the committee on revision favored the exclusion of associate members from the privileges of the floor and denied their presence at the meetings in case of an executive session. This proposition produced a very violent discussion, and Dr. Mason, after a rousing speech, made an attempt o put the association on record by moving that associate members be dispensed with altogether. The association refused to accept this proposition, and unanimously voted that it was desirable to retain the associate members. It was felt that it had become necessary to confine the active membership to *bona fide* central station men, and several amendments that were offered were directly with this point in view. After a protracted session of debate the matter of the constitution was dropped. The changes made were of about the following nature: Associate members retain the privilege of the floor, but special executive sessions may be held from which they are excluded. This provision secures the united action of the central station men, unembarrassed by outsiders, when secret discussion becomes necessary. The Executive Committee was also given the power to determine who should be the proper representatives of an electric light company at the convention. The object of giving this rather extraordinary power was to prevent representation of a company at the convention by any persons not intimately associated with actual central station work. The association felt a large part of the value of its deliberations results in the combined experience of the members, and if persons only casually connected with electric light companies were permitted to represent those companies the results would be less satisfactory. These two changes were the important ones, although some slight further modifications were adopted.

The business of the afternoon session was principally of the hearing of various committee reports. The president first announced the appointment of the committee to confer with the authorities of the Columbian Exposition. This consisted of Messrs. Alexander; Rose, of San Francisco; Hart, of New Orleans; Edwards, of Charleston, S. C., and the president. The report of the secretary and treasurer was then read and showed the finances to be in a most excellent condition. Mr. Garratt then interpolated a brief report on behalf of the special Committee on Resolutions on Deceased Members, which was appointed at last convention. The president then appointed a committee on nomination and the place of the ensuing meeting, and it retired to deliberate. The Finance Committee then read a report making certain recommendations for the better management of the books and a more satisfactory arrangement of expenditures: and then the Committee on Underground Conductors read a report of considerable interest. Judge Armstrong next presented the report of the Committee on the Relations between Manufacturing and Central Station Companies. This committee takes charge of a very important part of the work of the association, and Judge Armstrong's report was listened to with great interest by the members present. This committee, like the others, was continued. Mr. De Camp, chairman of the Committee on Data, reported that he had been unable to secure a meeting of the majority of the members, and therefore could not make any report except on his own responsibility. The committee was continued. Mr. C. R. Huntley spoke on a topic which had been assigned to him, as to how the association could best serve the interests of central station men. Mr. Huntley's remarks were brief, but he voiced the feeling of very many of the members in saying that this could best be done by making the association a purely business society for the mutual advantage of the members. The Committee on Nominations, which had been appointed previously, then re-entered the room, and recommended the re-election of the present executive board, with the substitution, by request, of Mr. DeCamp for Mr. Thurber. It also recommended that the next meeting be held at Providence, R. I. These propositions were both accepted unanimously, and the meeting then adjourned.

This closed a very interesting and useful session of the National Electric Light Association. Fewer papers were read than had been hoped for; but those that appeared were of no little interest, and especially the committee work was of a most important character; and it was felt at the conclusion of the convention that much had been done toward increasing the unity and usefulness of the organization.

Among those present at the convention were:

ALLEGHENY, PA.—A. Groetzinger.
ANSONIA, CONN.—F. B. Platt.
ATLANTA, GA.—John S. Alfred.
BOSTON, MASS.—P. H. Alexander, G. L. Austin, F. E. Barker, S. E. Barton, Capt. Wm. Brophy, A. N. Burbank, Louis W. Burnham, C. L. Edgar, F. E. Cabot, H. J. Conant, H. E. Duncan, H. H. Eustis, H. M. French, A. V. Garratt, C. M. Goddard, L. H. Hart, J. R. Lovejoy, A. F. Mason, E. C. North, A. C. Shaw, R. F. Ross, F. E. Pettingell, R. T. White, E. F. Woodman.
BRIDGEPORT, CONN.—W. C. Bryant, J. M. Orford, H. D. Stanley, O. S. Platt.
BRISTOL, PA.—Charles E. Scott.
BROOKLYN, N. Y.—E. F. Peck.
BUFFALO, N. Y.—C. Lee Abell, C. R. Huntley, W. H. McDonald.
CHICAGO, ILL.—W. P. Adams, J. P. Barrett, John W. Blaisdell, Chas. A. Brown, E. V. Cavell, Geo. Cutter, J. W. Dickerson, Fred Degenhardt, Henry C. Eddy, C. E. Gregory, W. A. Kreidler, Geo. A. McKinlock, E. L. Powers, J. W. Shay, J. H. Shay, H. H. Small, Gilbert M. Smith, Ed. F. Williams, C. H. Wilmerding, H. S. Winston, F. A. Wunder, John Young.
CAMDEN, N. J.—Hon. E. A. Armstrong, J. J. Burleigh, C. L. Rodman, Heber C. Robinson.
CLEVELAND, OHIO.—C. C. Curtis, W. B. Cleveland, J. B. Crouse, Benj. F. Miles.
COLORADO SPRINGS, COLO.—E. C. Wade.
DALLAS, TEX.—W. M. Clower, C. O. Harris.
DETROIT, MICH.—Jessie M. Smith, Fred. Whipple.
ELGIN, ILL.—G. S. Bowen.
FITCHBURG, MASS.—H. F. Coggshall.
FLINT, MICH.—A. G. Bishop.
FT. WAYNE, IND.—W. R. Kimball, M. M. M. Slattery.
HARTFORD, CONN.—W. G. Halm, C. L. Tolles, Francis P. Whiting.
KANSAS CITY, MO.—M. E. Bates, G. W. Hart, Geo. H. Hageman, E. R. Weeks.
MONTREAL, QUE.—A. J. Corriveau.
NEWARK, N. J.—C. O. Baker, Jr.
NEW BEDFORD, MASS.—Chas. R. Pine, Mr. Underwood.
NEW BRITAIN, CONN.—T. H. Brady, L. C. Whitney.
NEW ORLEANS, LA.—S. J. Hart.
NEW HAVEN, CONN.—J. English, C. D. Warner.
NEW YORK.—P. C. Ackerman, F. M. Adams, C. H. Barney, Oliver A. Brown, L. D. Beck, Dr. Louis Bell, Edward Caldwell, Capt. W. L. Candee, Wm. W. Castle, Stephen L. Coles, Francis B. Crocker, C. J. Field, G. H. Fisher, Wilfrid Fleming, A. R. Foote, R. E. Gallagher, E. T. Greenfield, J. W. Godfrey, R. J. Gray, W. H. Gordon, Wm. J. Hammer, Geo. H. Hartwell, H. M. Haines, W. J. Jenks, E. H. Johnson, W. J. Johnston, Jas. F. Kelly, Theo Larbig, A. B. Laurence, E. W. Little, Gen. E. O. Madden, J. P. McQuaide, Wm. Bracken, C. W. Spear, H. M. Swetland, Frank A. Magee, Geo. T. Manson, T. C. Martin, Geo. H. Meeker, T. McCoubray, E. Myerson, Geo. M. Phelps, Geo. B. Prescott, Jr., C. W. Price, R. W. Ryan, John A. Seely, L. W. Serrell, Ralph L. Shainwald, H. L. Shippy, H. L. Storke, C. E. Stump, J. B. Taltavall, Robert Taber, Wm. H. Temple, J. Van Gestel, C. S. Van Nuis, F. Warder, Jean A. Wetmore, Benj. R. Western, Jos. Wetzler, Schuyler S. Wheeler, G. L. Wiley, Harry W. Williams, E. E. Wood, F. P. Wisner, C. G. Young, W. F. Cullen, H. Ward Leonard, W. E. Morrison, S. Rosenstamm, H. L. Lufkin.
NORTH EAST, PA.—A. L. Daniels.
ORANGE, N. J.—Chas. Wirt.
PHILADELPHIA.—Henry N. Almy, C. A. Bragg, A. Bouneville, David Brooks, H. A. Cleverly, D. O. Conner, W. A. Drysdale, A. J. De Camp, F. H. Deacon, W. R. Hood, Norman Marshall, W. McDevitt, W. C. McIntire, Alfred F. Moore, Geo. F. Porter, O. D. Pierce, H. S. Smith, T. C. Smith, W. A. Stadleman, W. H. Shoemaker, G. A. Wilbur, Elmer G. Willyoung, Wm. Hazelton, W. F. Hanks.
PITTSBURGH, PA.—H. L. Angloch, S. A. Duncan, A. E. Carrier, J. W. Marsh, Morris W. Mead.
PLANTSVILLE, CONN.—H. C. Roberts, J. R. Stagg
POTTSTOWN, PA.—Chas. E. White.
PT. HURON, MICH.—W. F. Davidson.
PROVIDENCE, R. I.—Marsden J. Perry, Geo. H. Wood.
RUTLAND, VT.—M. J. Francisco.
SAN FRANCISCO, CAL.—Geo. H. Roe.
ST. LOUIS, MO.—Robt. McMath, C. C. Moffit, Russell Parker, D. R. Russell.
TOLEDO, O.—C. R. Faben.
TRENTON, N. J.—F. A. Perrine.
WATERBURY, CONN.—A. M. Young.
WILMINGTON, DEL.—H. B. Cobb.
WINDSOR, CONN.—M. E. Baird, A. D. Newton.
WASHINGTON, D. C.—F. W. Royce, A. M. Renshaw.
WORCESTER, MASS.—H. M. Smith.

The number of ladies accompanying those attending the convention greatly exceeded that of former years, and included Mrs. P. H. Alexander, Miss E. W. Armstrong, Mrs. G. L. Austin, Mrs. C. O. Baker, Mrs. C. H. Barney, Mrs. J. P. Barrett, Mrs. S. E. Barton, Miss Myrtis Barton, Mrs. Charles A. Bragg, Mrs. J. J. Burleigh and two daughters, Mrs. W. L. Candee, Mrs. Wm. M. Castle, Mrs. George Cutter, Mrs. A. J. De Camp, Mrs. C. R. Faben, Miss M. B. Ford, Mrs. M. J. Francisco, Mrs. R. E. Gallagher, Mrs. Harris, Mrs. G. W. Hart, Mrs. E. H. Johnson, Mrs. W. J. Johnston, Mrs. J. F. Kelly, Mrs. W. R. Kimball, Mrs. E. W. Little, Mrs. W. C. McIntire, Mrs. J. P. McQuaide, Mrs. George T. Manson, Mrs. A. F. Mason, Miss Kate Mitchell, Mrs. J. M. Orford, Mrs. F. E. Pettingell, Mrs. G. B. Prescott, Jr., Miss Ridlon, Mrs. John A. Seely, Mrs. M. M. M. Slattery, Mrs. W. A. Stadleman, Mrs. C. D. Warner, Mrs. E. R. Weeks, Mrs. Schuyler S. Wheeler, Mrs. Fred Whipple, Mrs. George H. Wood, Mrs. John Young, Mrs. A. M. Young.

Proceedings of the Convention.

FIRST SESSION.

The Association met at the Stockton House, Tuesday, Aug. 19, 1890, and was called to order at 10:30 A. M. by President Marsden J. Perry.

The president read the following address:

Members of the National Electric Light Association:

You are here to-day to erect by mutual action another mile-stone in the form of the volume that will be created to contain a record of your proceedings, to mark the progress of the development of the electrical industries. Short as the history of this development is, it has been so crowded and broadened by the eager enterprise that is characteristic of our people that no records are to-day sufficiently ample and complete to give any of us a correct knowledge of the present condition of the multitude of undertakings employing electricity in some form of practical application.

To supply this deficiency a "Memorial and Statement" has been presented to Congress in the name of this association, urging that the fullest possible investigation and report be made on the electrical industries by the Eleventh Census. This association can do no more important work for the interests it represents than to select from the Census reports certain points of inquiry and adopt measures to keep them continuously written up to date. Recommendation looking to this end may be presented by the Committee on Data.

As a general statement it may be assumed that there is to-day a central lighting and power station in operation in every town of any importance in the United States. An estimate made by and published in the August number of *Electrical Industries* makes the following showing:

Number of stations	1,379
Capital invested	$118,758,500
Number of arc lights	127,441
Number of incandescent lights	1,590,907
Engine capacity, horse-power	356,755

Eloquent as these figures are of enterprise and progress, they tell but part of the story. One startling omission is that of the electrical transmission of power for stationary and locomotive work. The statements, however, may serve the purpose of helping the imagination to picture the results that are to be shown by the census of the century in the year 1900.

It is a safe assertion that there is not a station in this country with a present capacity sufficient to satisfy one-twentieth of the demand for light and power that exists within the area of its practical working limits. To reach the consummation of ultimately doing the entire lighting and power service that is to-day being supplied by the use of agents other than electricity, is an undertaking worthy of the united efforts of all who are interested in the electrical industry. The foundation for such a growth must be laid in an unquestioned demonstration that investments in central stations for supplying light and power by the use of electrical currents are safe and profitable, that the service is—in comparison with that rendered by other agents used for similar purposes—a protection to life and property, and that the service can be employed with advantages in economy, health and comfort, by all users that cannot be realized by the use of any other agent.

Those who know best what is required to meet all issues and to establish a business involving the complex factors and conditions assembled in undertakings for central station work are those who have invested their money in it and are employed daily in its management. To them and their interests, which include that of all who manufacture apparatus and supplies, as surely as the greater comprehends the lesser, this association is pledged for well-considered and effective work.

In your deliberations and discussions you have an opportunity to show your thorough knowledge of the subjects in which you are interested. By your actions you can prove yourselves masters of the factors that induce progress and invariably lead to successful issues.

The Twelfth Convention of the National Electric Light Association is now open for the consideration of such subjects and business as may come before it.

The Secretary read the following announcement of the order of business:

For the purpose of securing orderly and prompt action for those attending the Twelfth Convention, the Executive Committee has appointed a Committee on Credentials, the members of which are Edwin R. Weeks, chairman; M. J. Francisco and John A. Seely.

The committee recommends the appointment of a Committee on Resolutions to consist of three members.

The Executive Committee believes that many questions that can be discussed with great profit to members of this Association do not come to the surface in set papers, nor in the reports of committees. That every such question may be considered, a call for "Topics to be discussed" will be made at each session except the last. All topics so proposed will be referred to the Committee on Resolutions, and if approved a place will be found for the topic in the order of business.

That members desiring to speak on an announced subject may secure the opportunity without confusion, each one is requested to hand his name to the Secretary before the subject is called. When the subject is before the Convention, the Chair will call such members to take part in the debate before it is opened to the Convention. It is hoped that members will take full advantage of this invitation.

Mr. Faben: I move that the recommendation just read by the Secretary be approved, and that the Chair appoint a committee of three on resolutions.

The motion was seconded and carried.

The President appointed as such committee A. F. Mason, C. H. Wilmerding and C. R. Huntley.

The President: The next thing in the order of exercises will be the reading of the paper on Electrical Industries and the World's Columbian Fair, by Prof. J. P. Barrett, of Chicago.

Mr. Barrett: With the permission of the Association I will thank our associate member, Mr. Blaisdell, to read this paper.

Mr. Blaisdell read the paper as follows:

ELECTRICAL INDUSTRIES AND THE WORLD'S FAIR.

It has been stated by competent authority that had it not been for the exhibition of the speaking telephone at the Centennial Exhibition at Philadelphia, the telephone would have been ten years later in receiving popular recognition and becoming a success. It is well known that the individuals who were nearest the telephone invention looked upon it with distrust, considered it a toy and an invention of no great practical importance. But Sir William Thomson, who was in 1876, as he is now, the recognized authority in electrical science, seeing the telephone at the Centennial Exhibition, became enthusiastic over it and endorsed it so warmly that it directed public attention to the invention and made it an immediate success.

Great as are the interests resulting from the telephone which was first publicly exhibited at the Centennial Exhibition at Philadelphia, the importance of this invention extends beyond the particular interests directly concerned. The public attention attracted by the telephone has stimulated activity in electrical industries which warrants the statement that the exhibition of the telephone marked a new era in electrical progress. The telephone and the relation of the Centennial Exhibition to the promotion of its popular success, are mentioned simply as an illustration of the importance of the World's Fair to electrical enterprises. Fourteen years have passed since then, and in three years more the Columbian Exposition in Chicago will be looked on to exhibit the progress which has been made since that date, and to be commensurate with an industry so progressive as to have absorbed an investment of $500,000,000 in the past ten years. It is not unreasonable to say that there will be more interest in the development of electrical science and in the evolution of the art of electricity as applied to various industries, than in any other one branch of the World's Fair. The rivalry in invention has led the United States to outstrip all other nations in the practical application of electricity. Thus it was that the electrical department of the United States Exhibition at the Paris Exposition saved the United States from complete disgrace; and yet the electrical department of the Paris exposition was the weakest feature of the entire show. Probably the United States in the Columbian Exposition cannot hope to equal Paris in the matter of its general exposition, but in machinery and in electrical matters particularly we should do a great deal better.

The most striking failure of electricity to play its proper part at the Paris Exposition was exemplified by the Eiffel Tower, which was not only not lighted by electricity, but even had its numberless gas jets lighted by hand, after the old fashioned way. Then the general lighting of the show was not made a feature, but only a very subordinate affair. The only place where electric lighting can be said to have been a feature was in the working of the colored fountains, an English invention and already rather old, but a fine thing and worth repeating at Chicago, with better facilities for spectators. The next most striking lack of the Paris Exposition was in the matter of electric street railways. It would seem that an exposition in these days should have an organized system of electrical locomotion for carrying a lot of passengers quickly and cheaply from side to side and from end to end of the entire grounds. Paris had a steam dummy going around two sides of the ground, but that was insufficient, and the cars were usually crowded just when people wanted to use them. That, however, was on account of the Exposition being such an unexpected and tremendous success. The only means of electrical locomotion used at Paris, was an electric crane running from end to end of the machinery building, very slowly, to give people a chance to see the various exhibits from above, and incidentally some rest and some air.

There was also no organized telephone exchange system at Paris. Considering that the Melbourne Exhibition of 1880 had a telephone exchange in full operation inside the grounds, doing substantial service to exhibitors, as well as to the officers of the Exhibition itself, Paris is to be pronounced behindhand in this respect. There was something done in the American section at Paris, for the offices of that section and for some exhibitors, but it was not very well done, and was on a very small scale. There may have been other similar telephones exchanges at work, but there was no good general system for everybody and no connection with the city.

It is the intention in the following paper to point out some lines in which the exhibition of that branch of industry, in which we are all interested, should be protected and promoted according to the brief consideration which the writer of this paper has been enabled to give the subject.

In the first place, electricity will find numerous applications in the way of actual service in carrying out the plan of the Exposition. By this I refer to the fire alarm protection signaling apparatus, electric lighting, both arc and incandescent, transmission of power, telephoning and telegraphing. The location of the Main Exposition having been rightfully settled in favor of the Lake Front, which is practically in the heart of the city of Chicago, and within five squares of the telephone central office, the fire alarm central office and the Western Union and Postal Telegraph offices, it will be a matter of no serious difficulty to make such connections with the general city electrical service as will give the Exposition the benefit not only of its own special outfit in each of these directions, but also the advantage of its outside connections. Aside from this application of electricity to the utility and necessities of the Exposition, the features in which we are all particularly interested are those which illustrate the progress that has been made in the science and in the art. The success that has attended recent electrical exhibitions, such as the one in Philadelphia in '85, and the one in the American Institute Fair in New York, give us some idea of what can be accomplished in this direction with the immensely multiplied facilities at the World's Fair in Chicago, and with the incentive to manufacturers and inventors which comes from having the attention of the whole world directed to their work.

With reference to telephones, as is generally known, the fundamental patent on the telephone will expire in 1893, and we may expect not only the inventions, accumulated and hoarded by the American Bell Telephone Company for the years that they have had control of the business, to be exhibited at the World's Fair, but also numerous other inventions which will be stimulated by the opening of the field to competition. Thus this feature should be given a much greater consideration, and more attention should be paid to it than in any previous exhibition. We have seen only the beginning of the growth of the telephone business. This is shown by the fact that in the city of Berlin there are now 13,500 subscribers, and the exchange there is growing at the rate of 3,500 per year. I predict that in the city of Chicago inside of ten years there will be 30,000 telephones in use. Such a great increase in the use of telephones calls for apparatus and appliances, the invention of which will tax the best talent of the country for years to come. Of course, in addition to the historical exhibition, and the exhibition of recent inventions in telephones and apparatus applied to telephony, there will be immense numbers of telephones used in and about the buildings of the Exposition.

The matter of telegraphy also should receive its due share of attention. The different forms of quadruplex, the use of dynamos instead of batteries for furnishing the current, and other inventions in which the recent history of the telegraph is prolific, should each and all be suitably presented. Police and fire alarm apparatus of the latest design and the best manufacture, together with all appurtenances, will attract a large share of attention.

The telautograph, which by 1893 will undoubtedly be a practical success, even if it shall not have ceased to be a novelty, will also come in for purposes of exhibition as well as for extensive practical use.

Motors for driving machinery, furnishing power for various purposes, running street cars, etc., will perhaps be even of more practical benefit than any other application of electricity; while electric lighting apparatus of various kinds will take the lead undoubtedly, as it now does, over all other electrical industries.

It is proposed to connect the two parts of the World's Fair, one situated on the Lake Front and the other at Jackson Park, by means of a railroad built out on the lake. The expediency of adopting electricity for motive power on this railroad is at once obvious. Thus the two features of usefulness and exhibition can readily be combined, and in addition to the direct transmission of power storage batteries could be employed for traction purposes on this road.

It is difficult in enumerating the different departments of electrical enterprise to foresee all of them, and particularly to foretell the relative importance of the different ones three years from the present time. In no field of human activity is invention so active and enterprise so energetic, and when we speak of the different forms of application of this science which are well known at the present day, we all know that we are simply on the threshold of future developments which may be confidently expected. At no time in the history of the world has there been so great activity in any given direction as there now is in the department which we represent, and too much cannot be said with reference to the importance of having adequate facilities in the coming World's Fair to display the various industrial and artistic applications of electricity.

What will be exhibited at the World's Fair will undoubtedly be a revelation to the visitors. It should be the aim of the people having the exhibition in charge, so to organize and classify the exhibits as to present clearly and forcibly the progress of the art and the present state of its various departments. A chaotic exhibition of the products of the different manufacturers would accomplish something in the way of creating astonishment and mystifying the beholder. This is not what is desired. It is desired that the World's Fair, as a whole, and the electrical exhibition, as perhaps the most important industrial feature of the exhibition, be made an education. It is not too early now to lay plans for the proper presentment of electrical industries for this great Exhibition of 1893. The combined intelligence of the men who are to-day pushing forward electrical enterprises, working in harmony, will be able to accomplish great results, results which will surprise all of us. But the element of time must enter into all calculations; especially is this the case with a subject so large and so involved as the suitable presentation to the public of the rapidly growing electrical enterprises in their various fields.

The Exposition should be made just what its name implies, a practical exposition of the progress and advances made in the several branches of the science of electricity, and the exhibits should be so arranged that the various improvements may be seen and appreciated at a glance. Thus will the real object of the Exposition be accomplished and a saving of much valuable time to the visitor be effected. For it is quite probable that fully 50 per cent. of the visitors to the electrical section will go there with the earnest desire to become thoroughly familiar by practical observation and study with all that has been done in some certain industry, either to aid in carrying on a certain line of study or with a view of selecting what they may there conclude is the apparatus best adapted to their needs. In either case, time will be an important and valuable factor, and how to enable each visitor to quickly and understandingly grasp the more important details and points of superiority of any exhibit should be the main object of the respective exhibitors.

The usual method followed in the small expositions has been to allot a certain space to each exhibitor and allow him to place therein whatever he may desire to bring to the notice of the visitor. This is a good plan, and one which proves economical in many ways to the exhibitor. Another plan would be to allot space for the various types of apparatus, irrespective of the main display of the exhibitor. That is, to place all telephone apparatus and everything thereto pertaining in close proximity; the same with telegraphic apparatus, arc lighting dynamos, incandescent machines, motors, etc. The carrying out of such a plan will, of course, give two or more separate exhibits to each manufacturer, and thus entail some slight additional expense, both in the matter of suitable furniture, and possibly in the matter of attendance; but all this additional outlay would be more than returned in the excellent results attained, and in the simplifying of the study of any particular type of apparatus, to say nothing of the greater publicity given each exhibit. Of course there would be no objection to an exhibitor's reproducing a complete display of all his wares in the space allotted to him for his headquarters, irrespective of the fact that many articles may also be shown in the respective space to which they belong.

As far as possible a complete specimen of every article and every size should be placed on exhibition. For instance, in the line of motors, there should be one of each size from the smallest to the largest turned out; and so with dynamos, batteries, etc. In the space allotted to the display of testing instruments the showcases should be placed on a flooring above a foundation made sufficiently solid to prevent oscillation of the needle, or injury to the more delicate parts from vibration or other similar cause. Every article should have a neatly printed card attached, of size uniform in proportion to the character of the object displayed, bearing the name of the article, the manufacturer's address, and a brief description of its intended use, the same appearing in English, French, German and Spanish.

At the present time there are about 430 separate companies or individuals whom we can expect to apply for space, many of whom will have but a single article or two to exhibit. But every one of this number will probably defer action until the last possible moment, unless the importance of securing the necessary space and having his exhibit in readiness within the appointed time is impressed upon him. Some of the manufacturers will have to be coaxed into making exhibits, while others will hesitate on account of the expense entailed. The chief or his secretary must attend to all of this, and must spare no pains to secure not only an exhibit, but the *best exhibit* possible for each manufacturer to make.

Great assistance in carrying out a comprehensive and systematic plan for the Exposition may be expected from the United States Census, the report of the Electrical Department of which is looked for with great interest.

Mr. Faben: There certainly will be no enterprise presented at the World's Fair that will interest central station men as much as will the electrical department. The amount of detail required to develop a proper exhibition of the appliances presented there, and to induce manufacturers to present those features of their business that will be not only of interest to themselves but to central station people as well, and the amount of work involved in the undertaking, demand that action should be taken by this Association now. This being a central station association, the central station people ought to go to work very promptly to lay plans for securing a proper exhibition at that time. For that purpose I would like to present a motion as follows:

"That a committee of five be appointed, of which the President of the Association shall be, ex-officio, one, the other

four members to be appointed by the Chair, to meet the authorities of the Columbian Exposition and secure suitable facilities for the proper exposition of electrical manufactures and appliances, and in general to work for the interests here represented, and to offer to the authorities of the Exposition the co-operation of the National Electric Light Association to aid in making the Exposition a success.

"That the committee request the selection by the authorities of the Columbian Exposition of Mr. John P. Barrett, of Chicago, to have the practical charge and control of the electrical department of the World's Columbian Exhibition."

Mr. PHELPS: I have great pleasure in seconding the resolution which Mr. Faben has offered, and both features of it. That is, the appointment of a committee to secure suitable facilities, and tendering the coöperation of this body with the authorities of the Fair, and also recommending for appointment Mr. John P. Barrett. The paper which has been read to us this morning is about as good evidence as we might need perhaps of the fitness of Mr. Barrett for that work, although doubtless the most of us knew well enough before. A further reason is that Mr. Barrett has already been commended to the World's Fair Commissioners by the signatures of very many of the most prominent electrical people, electricians, electrical engineers, manufacturers and users of light and power. I think that it would be eminently fit and proper for this Association to take such action at this time as has been proposed. The sooner such action can be had the better it will be for the exhibition. I presume that there is no doubt in the mind of any member of this Association of the entire fitness of Mr. Barrett for the position. I therefore second the motion.

Judge ARMSTRONG: I am most heartily in favor of all of the resolution except that part of it which recommends the appointment of some particular individual. I think that this Association would make a serious mistake if it did that thing. I have myself recommended the appointment of Professor Barrett, and personally I am heartily in favor of his appointment, and personally am willing to do everything possible to secure that appointment; but it seems to me that the Association would be making a serious mistake if it lent itself to a recommendation of any individual for any appointment. (Applause.) I should be very sorry to see this Association join in recommending anything where there is a possibility of there being, with merit, some competition against it; and I believe that every member of the Association would join with me in deprecating the recommendation of any thing, no matter how good it might be, if, with merit, some competition could be brought against it. We want to be in the position, beyond any question or any cavil, of disinterestedly and impartially standing here as representing all and everything connected with the industry with which we are associated. We do not want to have the slightest possible suspicion that we are biased in any direction. Therefore, I am very glad to vote for this resolution if we may have that part of it omitted. I may say to the gentlemen who have moved and seconded the resolution that I am willing to join with them, individually, in doing everything possible to have the gentleman who has presented such an interesting paper to us appointed to the position they desire to see him appointed to, but do not let this Association adopt such a resolution. It would be weakening to us, and I think it would be weakening to him. (Applause.)

Mr. ALEXANDER: The resolution offered by Mr. Faben, coming immediately after the paper by Professor Barrett was read, puts Professor Barrett himself in rather a delicate position. His paper speaks particularly of the advantages that could be derived by the proper arrangement of electrical exhibits at the Chicago exhibition; and I do not think that he himself would like the resolution to come up now, at least not in that form. If notice had been given by these gentlemen that such a resolution would be brought up in the course of the session it would have given opportunity to gentlemen who are interested in the subject to confer with each other regarding a proper appointment. I therefore move that that resolution be tabled.

Mr. DEGENHARDT: I would be untrue to the city of Chicago and to my friend Prof. Barrett if I did not raise my voice in support of his appointment. As I understand it, the resolution has for its object the successful operation of the World's Fair. In the appointment of a neutral man like Prof. Barrett, we have in him all the qualifications set forth in the resolution; and I would like to add that the very support which has been granted to him by signatures throughout the United States is a sufficient guarantee of the feeling which must exist. Of course, we Westerners recognize the fact that you are dying very hard back here, and the World's Fair seems to be the red flag that excites the bull, so to speak. Prof. Barrett is known throughout the United States as an absolutely neutral man. I think that he is free and untramelled. He has no affiliations that we know of, and is, therefore, a man qualified for the position. I think that this Association owes the city of Chicago as a debt the adoption of this resolution.

Mr. DUNCAN: At a former stage of the proceedings of this body this morning, as I understand it, we adopted as the report of the Executive Committee a resolution to the effect that a committee be appointed by the Chair to whom topics presented for discussion should be referred; and the Chair appointed such a committee. As a substitute for the pending motion I move to refer these resolutions to that committee.

Mr. DECAMP: I think, Mr. President, if we undertake to do that we will never do any business. Resolutions are offered, nine-tenths of which it is perfectly competent for us to discuss in this connection; and if I understand Mr. Duncan rightly, these resolutions are discussed (if that is the proper arrangement) and are afterwards referred to this committee.

Mr. DUNCAN: You have appointed a committee to report upon resolutions. It is usual to refer your resolutions to that committee. That committee considers them and reports the resolutions back to the body, making a definite report one way or the other. That then brings up the whole subject matter, and then you can amend or do as you please with the resolution, and we can proceed with the orderly conduct of business. But, if it is the decision of this body to discuss this resolution first, them I am ready now for the discussion. That is all that I am trying to get at. In order to test the sense of this body and to ascertain what our understanding might be in the appointment of the Committee on Resolutions—it was to ascertain the feeling of the body on that that I made that motion. Now, if this discussion is to go on, then let us finish the subject matter up now, and we will not need to send it to the Committee on Resolutions. Otherwise it would properly go to the Committee on Resolutions, be reported back, fully discussed and then decided. That is my purpose—not to cut off debate, but simply to come to an understanding.

The PRESIDENT: I understand you now to move as a substitute to refer the original question to the Committee on Resolutions?

Mr. DUNCAN: Yes; the whole subject, as offered by my friend on my left (Mr. Faben).

Mr. FABEN: As the mover of that resolution I will say that I offered the resolution as I considered in the interest of the electric light associations. I have not had the pleasure of knowing Mr. Barrett so well as many members here, but the knowledge I have of the man from the say-so of the members, and my judgment of the matter, led me to believe that he was a suitable person for that position. The gentlemen seem to lose themselves a little here in considering this as an appointment. The National Electric Light Association cannot appoint a man to fill that position, but they certainly can pass their judgment on who their choice will be.

Mr. DUNCAN'S motion was carried.

The PRESIDENT: The next order of business is the report of the Committee on Copper Tariff, by Mr. Charles A. Brown, of Chicago.

Mr. BROWN: We had expected that by this time Congress would have passed a tariff bill and that thus there would be some definite result with reference to the duty on copper, in securing which the committee could claim some part. But you all know what the present situation regarding the tariff bill is. The original bill introduced by the Committee on Ways and Means provided for a reduction of 50 per cent. of the duty on various forms of copper. This provision of the bill as introduced into the House was not changed in the House. In the Senate the clause relating to the duty on copper was amended by further reducing the duty to one-half cent per pound on ores and one and one-quarter cents per pound on ingots, bars, plates and pigs, being a reduction of 70 per cent. in one case and 80 per cent. in the other from the present schedule of duties. It is reasonably sure that if the tariff bill becomes a law at the present session of Congress the duty on copper will be reduced at least 50 per cent. Your committee have secured something over 500 signatures to a petition addressed to the Committee on Ways and Means requesting the abolition of the duty on copper. We have mailed something over a thousand circular letters and have made in addition to that a good many personal solicitations. Mr. Phelps, of the committee, personally went to Washington with the signatures to this petition and presented them to the Committee on Ways and Means with a brief but forcible argument in favor of the petition. As no appropriation was made by the Association to meet these expenses the members of the committee themselves advanced the necessary money for postage, traveling expenses, express, etc., to the amount of $110, in carrying out what seemed to them to be the spirit of the instructions contained in the resolution appointing this committee.

Mr. DECAMP: I move that the report be accepted and the committee continued. I would like the committee, in its next report, to give us some idea of whether the manufacturers will get that reduction or whether we will get it.

The motion was carried.

Mr. ALEXANDER: I also move, in connection with that, that the treasurer be instructed to reimburse the committee for its outlays, not to exceed $110.

The motion was carried.

The PRESIDENT: The order of business of the morning session appears to be exhausted. Is any further business to come before the session? Have any members any topics that they would like to have discussed at some future session?

Mr. DECAMP: I want to give notice of my intention to offer a resolution to consider the action taken by the Committee on Resolutions. My reason for offering that is this: While the plan proposed is a most admirable way of presenting the business for a body that has unlimited time to discuss and get through with its business, I think if that resolution prevails that we will do very little business in the three days in which we meet to transact our business. I think it is too cumbersome for this Association.

Mr. FABEN: I do not think I understood the announcement as a majority of the house seem to understand it, and for the information of the members I would ask that that announcement be read again relative to the appointment of a Committee on Resolutions.

Secretary FOOTE: The Executive Committee recommend the appointment of a Committee on Resolutions, to consist of three members, and as a subsequent item in the topics proposed for discussion it was proposed that all topics be referred to the Committee on Resolutions, and if approved a place be found for them in the order of business. We did not know how many topics might be proposed and what the character of them might be. Some of them would want more space on the order of business than others, and it was proposed to let all these matters go to the committee, so that they might be placed in due order on the calendar.

Mr. DE CAMP: That was my understanding of the resolution—that is, that it does not apply to any resolution that might be offered here on the floor.

Secretary FOOTE: Unless referred by order of the Convention.

Mr. ALEXANDER: I move you, sir, that we now adjourn until the afternoon session.

The PRESIDENT: I wish to make an announcement here. The following topic has been proposed for discussion: "The Proper Classification of the Lighting Power of Incandescent Lamps." Dr. Louis Bell, editor of THE ELECTRICAL WORLD, will open the question. We will make place for that. The announcement is made in advance so that all who desire may have an opportunity to be present and take part in the discussion.

The motion to adjourn was then carried.

SECOND SESSION.

The Convention was called to order at 4 P. M.

The PRESIDENT: I have received this telegram:

DENVER, COLO., Aug. 19, 1890.

To Marsden J. Perry, President.

Denver, Colo., sends greeting to the Twelfth Convention of the National Electric Light Association. May the owl be wise and the spring chicken not devoured. The commutator brush should not be allowed to spark, and may you all see the rising sun without the pendant saw-buck. I regret not being able to be with you. M. D. LAW.

The PRESIDENT: The first thing on the opening of this session will be a five minutes' talk by Mr. Brooks, of Philadelphia, on the use of liquid insulation for underground conductors.

Mr. BROOKS said:

It is rather embarrassing, Mr. President, to come before so large an audience. The five minutes I take will be a brief reference to the advantage of a liquid insulation for underground conductors carrying currents of high voltage. Gentlemen, since electric lighting came into use it has been found that the ordinary tests for insulation do not apply; that is, a test with a galvanometer and a voltaic battery of, say, 1 to 500 cells. That has become apparent, and they have adopted other means in Paris and in London for testing the insulation of conductors that have to carry very high intensity currents. We have seen this noticed in many periodicals. Mr. Wm. Maver, Jr., in an article published in THE ELECTRICAL WORLD, March 1 of the present year, states that a cable measuring 20,000 megohms per mile for insulation in the factory broke down by a dynamo current of 600 volts after being drawn into a conduit. Now, in the ordinary test, if a person should go and measure the insulation of an electric light cable, and he found it was 20,000 megohms per mile, and he took another system of insulation and found that it was only half a megohm per mile, as a general result he would take that which stood 20,000 megohms to the mile. But if you apply to it a current of high voltage from an induction coil or a Holtz machine, you can prove that the one with the 20,000 megohms insulation per mile was broken down by from five to ten thousand volts. Now you take the same No. 4 conductor and insulate it in oil for 20 feet, just as an experiment, and raise the temperature to 200° Fahr. and apply the galvanometer, and it is not half a megohm per mile—just about the one-fortieth part of the one that Mr. Maver speaks of, but when you come to apply the induction coil or the Holtz machine and test it to produce what is sometimes called the break-down or a disruption, it can be broken with 10,000 volts when the other cannot be broken with 500,000 volts. There is the difference between the testing of the insulation of a cable, or an insulator, or a dielectric, if you please, testing it with the ordinary delicate galvanometer, static galvanometer, and testing it for standing a current of high voltage. Now if the current applied to a conductor tests half a megohm per mile, the temperature of the insulation being 212° Fahr., that would not show much; no one on first sight would buy it; but if you are going to purchase a cable and test it as they do in England, or give the guaranty as they do now in England, there would be five parts of current going through the insulation to five hundred thousand and five parts going through the conductor; and the small proportion that goes through the insulation is a mere bagatelle, but it stands the current. These are experiments that I have made in Philadelphia, and I would do it here with a Holtz machine, but the atmosphere in the summer and especially on the sea shore is very unfavorable to the use of a Holtz machine.

Mr. Maver, in the article in THE ELECTRICAL WORLD, already referred to, states that a cable measuring 20,000 megohms per mile for insulation in the factory broke down by a dynamo current of 600 volts after being drawn into a conduit.

Twenty feet of that cable would give the proportional insulation of over 5,000,000 megohms, yet it is broken down with the tension of less than a thousand volts.

Now, if we take the same copper conductor and insulate it with cotton or other textile covering to one-eighth of an inch thickness and immersed in oil, we do not get so high insulation measured with the galvanometer, but it is not punctured or disrupted with a Holtz machine or induction coil by the application of a current of 500,000 volts.

It is easily seen to be very much more difficult to pass a spark through oil than through the air. We twist together two small copper wires, each covered with one thin layer of cotton, the ends of the wires are separated below the twist and the twisted portion immersed in oil, the upper ends each being attached to one of the rods of the Holtz machine. After the discs are set in motion sparks will pass between the two balls until they are separated an inch to an inch and a half, or until the spark passes from wire to wire in the twisted portion. The distance between the knobs as they are gradually separated is the length of spark and corresponding electromotive force required to rupture the insulation between the two wires. If an inch, it is by the authorities 23,400 volts. So long as the current is applied it passes from wire to wire through the insulation after once ruptured, but stopping the current, the insulation is soon restored.

Bearing upon this feature of restoration of insulation, it is the fact that of the 53 conductors laid for the Pennsylvania Railroad Company three years since not one of them has for a moment been interrupted by lightning or any other cause, nor have they cost one cent for maintenance.

The total length of conductors is something over 70 miles.

Taking Chief Walker's report of the total number of miles of overhead wires in Philadelphia, as compared with the number of linemen employed in their maintenance, I find there are two linemen or more for every 70 miles of overhead wires, and, at the rate of $2.50 per day, there has been a saving of $4,500 in maintenance as compared with overhead wires during the past three years.

In connection with the fact that oil is so little affected by currents of high voltage, it is well to bear in mind the yearly expense caused by interruption of river cables by atmospheric discharges. Again, a fault in ordinary insulation is developed into a perfect ground by currents of high tension.

Referring to the jar again, if the insulation is punctured, it is restored at once by agitating the liquid. In iron pipes the liquid is continually moving, owing to contraction and expansion of the oil from changes of temperature, and no chance for the current, through a fault or weak spot, to develop into a perfect ground.

This system of liquid insulation is as cheap, first cost, as overhead systems, all things considered.

And how about conduits or subways? I learn from official statements that they charge a thousand dollars per mile per annum for the use of a duct in Chicago and New York, and further, that an electric light conductor carrying a thousand volts costs a thousand dollars per mile or more for maintenance. Two thousand dollars is the interest on $33,000 and over at six per cent. Can arc lights be furnished under these conditions at a living profit?

I shall not go into the cost, inconvenience and dangers of subways. Those that have used them, and otherwise not interested, can tell all about them.

Last summer I went to Europe and started the business of laying electric light mains. My patents were put in the hands of Johnson & Phillips, London, and they have been very successful, having laid many installations without a single failure or interruption. Their guarantee is that not one-thousandth part of the current per mile is lost.

Underground conductors and underground systems are not popular on account of cost. As before stated, they are as cheap by this system as overhead wires and cost comparatively nothing for maintenance. When electric light companies see their way clear to put their conductors underground I shall be happy to assist them. I will lead the horse to water and hold the bucket for him to drink, and if he doesn't choose to drink he can let it alone. I have been asked and summoned as an expert before legislatures and councils to prove the feasibility of putting wires

underground—the whole amount of that business has been to help them to get a better price. It was walk up to the captain's office and settle. I shall not enlist in the service of those patriots any more.

The PRESIDENT: The next thing in the order of business of the afternoon session is a paper on Dangers from Electricity, by Prof. Henry Morton, of Stevens Institute of Technology, Hoboken, N. J., and will be read by Mr. Alexander.

Prof. MORTON'S paper was as follows:

THE DANGERS OF ELECTRICITY.

When the development of electric currents, on a large scale and at a small cost, first became possible by reason of the discoveries of Faraday, Wilde, Gramme, Siemens and others, the questions of the dangers to life and property attending their use was brought prominently before the public, just as the dangers attending the use of steam, of rapid locomotion on railroads, and of dynamite were brought to the attention of the world when these powerful agencies first left the experimental laboratory of the chemist or engineer to take their part in the ordinary labor and business of life.

In each instance alike there was a class of people who took the narrow and partial view, that if an agency was dangerous it should be excluded altogether from public use, or, what amounted to the same thing, be surrounded with such exclusions and limitations as would rob it of nearly all its capacity for usefulness, and restrict all possibility of advance and development in its application. Thus laws were actually passed in England on the first introduction of steam limiting the pressure in boilers to 30 pounds on the square inch. The first railroad charter contained a clause limiting the speed of trains to 12 miles an hour, and when a speed of 30 miles was suggested it was ridiculed in a prominent journal of the day as an idea simply insane, and it was said that people would just as soon be persuaded to allow themselves to be fired out of cannon as to be hurled along at such fearful velocities, which would, without doubt, have the most disastrous effects upon the circulation of the blood and other vital actions.

Some of us can also recollect the excitement produced and echoed in the press on the introduction of dynamite, and the stringent laws regarding its transportation, which in many cases only increased the danger to the public by occasioning its surreptitious conveyance in passenger and ordinary baggage cars. We shall have to be very young, indeed, not to remember the great popular excitement brought about by the daily press when electric lighting first appeared in the streets of New York, and when flashes of flame were described as proceeding from a horse that had run against an electric wire.

In all the older instances matters have settled themselves in accordance with the laws of human progress and the diffusion of intelligence, and we now have boilers running at pressures of 140 pounds and upward, trains going more than a mile a minute, and gunpowder largely superseded by dynamite. What is more, the accidents and injuries actually produced by these several agencies have been vastly less than those caused by the things which they replaced. A much smaller number of people are killed or injured by high-pressure boilers than by low-pressure ones. How rarely do we hear of the explosion of locomotive boilers, which usually carry 140 pounds pressure? The accidents to express trains are as nothing compared to those occurring with freight trains, and the loss of life and injury to passengers by rail is insignificant in its percentage to the number carried, when compared to similar loss and injury incurred in the days of stage coaches. The same relation has been found between dynamite and gunpowder, the former having largely reduced the proportion of accidents and injuries as compared with the work done.

Two lessons are very plainly taught by the facts of history above alluded to.

First—The world is not going to be frightened away from a new and valuable source of power by the circumstance inseparable from the very nature of all powerful agencies, that it is dangerous if not adequately controlled; but, on the contrary, will develop the new power to an ever increasing and therefore more (possibly) dangerous intensity.

Second—Intelligently managed and controlled, the most powerful, and therefore, in a sense, dangerous agencies, become the most efficient protectors and servants of man, and not only aid him in his mission of subduing and utilizing nature, but actually protect him in his work.

Without these "dangerous" agencies man would be reduced to the lowest condition of savagery, where he would be at all times helplessly at the mercy of the "elements" or the blind forces of nature. With them he not only defies and subdues the beasts which would otherwise be his superiors, but even conquers and renders tributary to his comfort and advancement those vast forces which control the entire matter of the Universe.

Applying these lessons taught by the past history of the world in parallel cases to the problem of the distribution and use of electricity, we see in the first place that the way to deal with its dangers ought not to be the timid, obsolete way of prohibition, or of unintelligent restriction, such as that which proposed the exclusion of locomotives from railroads, or the limiting of their speed to 12 miles an hour, but the sensible way of providing adequate safeguards to the new power, and with these allowing it to follow its natural line of development and growth into higher and higher ranges of intensity and consequent efficiency.

It is too well known to all to need statement, that the methods thus pointed out by history and taught by experience have not been by any means universally advocated or followed, and that while many have loudly demanded the exclusion of powerful electric currents, or the limitation of their intensity to what they suppose to be necessarily harmless ranges, the users of such electric currents have in too many cases neglected the most obvious precautions.

It is only fair to say in explanation of this latter statement, that this neglect has in many cases been brought about by obstructions thrown in the way of good work by those who were exciting themselves for the total abolition of dangerous currents, and who, like certain "total abstinence" advocates, objected to every mitigation of evil they attacked, because any such improvement weakened their case against it.

As regards dangers to property from fires, the matter fortunately fell at an early period into the hands of the Board of Fire Underwriters, who, in a judicious and business-like way, investigated the subject and formulated such rules as have proved eminently satisfactory, and have proved that under proper regulations as to good work and means of protection, electricity is by far the safest means known to us for the distributing and development of light, so far as "fire risks" are concerned.

In view of the satisfactory results thus obtained I regard it as a fortunate circumstance that the other part of the problem, namely, that relating to dangers to human life, has been recently taken in hand by a similar organization known as the "Employers' Liability Assurance Corporation." This association, after collecting a mass of material from a great variety of sources, some time since formulated a series of rules for the protection of those employed in erecting and operating electric apparatus involving the use of powerful, and therefore dangerous, currents. These rules have been examined and approved by several of the managers of prominent electric companies, and so far it would appear as if no accidents have resulted from the use of electric currents where these rules have been followed, and that most if not all the accidents which have occurred would have been prevented had these rules been followed and obeyed. Having had something to do with the framing of these rules, it is my chief object in presenting the present paper to secure their criticism by those best able to perceive their imperfections, and such suggestions as may lead to their beneficial modification or extension.

I therefore quote them as follows:

First. Do not touch or handle any electric wire or apparatus of any sort while standing on the ground, or while in contact with any iron work, gas or water pipe, or stone or brick work, unless your hands are covered with rubber gloves, and you are provided with such properly insulated tools as have been declared to be safe and in good order by the electrician or other competent officer of this company. If it is at any time necessary to stand on the ground, or on any surface not insulated from the ground, while handling electric wires and apparatus, rubber boots or an insulated stool should be used. In moving wires, hanging on or lying over electric light wires, lamps, or fixtures, use a dry hand line.

Second. Never handle any electric wire or apparatus with both hands at once when this can be avoided, and, if it is necessary to do so, be sure that no current is present, or that one or both hands are protected by rubber gloves or other efficient insulation.

Third. When handling line wires, treat each and every wire as if it carried a dangerous current, and under no circumstances allow yourself to make contact between two or more wires at the same time.

Fourth Never open a circuit which has been in use without giving notice to the superintendent, or whoever is in charge, of your intention to do so, and at the same time request that the same line be opened at the main station, and kept open until you have given notice that your work on that line is complete.

Fifth. In the dynamo room never go near the belts or dynamos, nor touch any apparatus unless you are fully informed and instructed how to do so.

Sixth. Tools used by linemen should be provided with insulating handles of hard rubber or other equally good insulator. It is the duty of each lineman to look after his own tools and see that they are in good order, especially as to their insulation. "In construction work, a space of at least 20 inches must be left between the holes for pins on the cross arms, so that a lineman may get to the top of the pole and work without danger."

Seventh. Lamp trimmers and others engaged in the care of lamps must see that the switch putting the lamp in circuit is turned off before they handle the lamp in any way.

The same insurance association has collected the authentic records of a number of so-called "electric accidents" or accidents happening to the employés of electric companies. I have now before me the abstracts of 91 such cases.

The first thing that presents itself in looking over this set of abstracts is that very few of the accidents are in any way attributable to electricity directly, but would have occurred had the establishment in question been any kind of a factory where power was being used, or any place where heavy objects were being moved. A few examples will illustrate this, thus:

"No. 1. While steadying with a pike-pole a large electric light pole which was being placed in position, a passing 'low-gear belonging to the Standard Oil Company ran over ankle."

"No. 2. While assisting in hoisting a stick of lumber from the street to the second floor of electric station, was injured in right foot by having the stick fall upon it."

"No. 9. Was going to dynamo, stepped on iron plate temporarily covering a belt hole in floor. The plate tipped and he fell partly through the opening, injuring himself internally."

"No. 17. Was oiling rocker shaft of engine near fly-wheel; leaned back too far and was struck on head by spider of fly-wheel."

The above are fair samples of the rest; and, in fact, out of the 91 cases but 15, or about 16½ per cent., have any direct relation to electricity. As I have already mentioned, of the 15 cases in which the injury was in any way caused by electricity, there are none in which the accident would not have been avoided if the above quoted rules had been observed. Thus, beginning with first in order as arranged in the abstracts, all before it having no direct connection with electricity, we have:

"No. 11. While removing the wire from a Brush dial or regulator which had become short circuited, was slightly burned on two fingers of right hand."

In this case the beneficial effect of rule No. 2 was manifestly expressed, and had the spirit of rule 7 been complied with, even the slight injury experienced would have been avoided.

The next in order is:

"No. 20. Was putting carbon in electric lamp which was out of order and failed to burn. Received charge of electricity, which caused him to fall down from step ladder on to steam radiator. Two ribs broken."

This would clearly have been avoided by an observance of rule 7.

Time will not permit me to quote all the 15 cases, and I will, therefore, only repeat that they would, all of them, have been avoided by a strict observance in form and spirit of the above quoted seven rules or directions. Of course I do not mean to imply by this that these rules are perfect or complete, but only that they seem to be in the right direction, and to furnish a starting point from which further developments may proceed.

No one having even an elementary knowledge of electricity as it existed ten years ago, needed or needs to be convinced of its power to do harm where all safeguards are removed, and the occasional declarations of its harmless character which have been uttered can only be accounted for by reference to that combative disposition which impels some minds always to take a view in opposition to any which may be expressed, and gives birth now and then to a book or pamphlet disproving the law of gravitation or the solar origin of light and heat. To say this is, however, far from agreeing with the other extremists who would banish electricity from our daily walks and occupations, or place it under restrictions which *might* render it harmless, but which *certainly would* render it relatively useless for the countless purposes in which its efficiency demands its full development. The true opinion is that which is supported by past experience, and which advocates the fullest developments of power to which this agency can attain, combined with the use of all the means of protection by which human intelligence can protect itself while using to the utmost this potent and, therefore, dangerous weapon in our victorious contest with the inimically destructive forces of nature.

The PRESIDENT: The discussion of this paper will be opened by W. R. Freathy, of Boston, after which it will be taken up for general consideration.

Mr. FREATHY: In my observations on Prof. Morton's paper I should have liked to avoid if possible all reference to the company I represent, because it might be said that my company, like a great many individuals connected with the business, has its own axe to grind. Well, my company has. But my company has another object in view which I think will commend itself to you, and that is to bring about a better condition of things than exists at the present time in connection with the instructions to employés of electric light companies with regard to the dangers which surround them in carrying on their daily operations. When my company started in business here a few years ago it found that in consequence of its being the first one to introduce what is known as employers' liability insurance in the United States it had really no experience to guide it upon which it could found rates of premium for the various electrical risks. They therefore had to refer to their experience in England. But there they found themselves somewhat in the same difficulty, as electrical lighting was in its infancy, and very little or no attention had been paid to the collection of statistics with regard to accidents to electric light employés. They therefore laid down this basis of charging a rate to the electric light companies: To consider an electric light company in the nature of an ordinary producer of any article, and to add to that a certain percentage for the known or unknown risks which might be incidental to their business. They therefore established what they considered to be a fairly reasonable rate to charge the electric lighting employers in order to protect them with regard to their legal liability for accidents to employés. But, in the course of a short time they found that the rate was inadequate. They found that several serious accidents occurred among their policy-holders, and what was of greater importance to them in carrying on their business, they found that the prejudice of the public, which was aroused by the press from time to time, whenever an accident occurred, for instance, similar to those which occurred in New York—they found that the prejudice which existed in the mind of the public was so great that when a suit was brought against a company for an accident which had occurred to an electric light employé, and he demanded compensation or damages from his employer for his injuries, it was utterly impossible to carry that case before a jury on account of the prejudice which existed in the minds of most people against electric light companies, it being considered that electric light companies were carrying on their work regardless of the dangers by which their men were surrounded. As these cases went on accumulating we were compelled, as business men, to consider what was best to be done. First of all, we had to protect ourselves from loss, and the result was that we were compelled to increase our rates of premium by nearly 100 per cent. We then set ourselves to try to find out whether we could do anything to bring about a better state of things with regard to the employés of electric light companies, and, if we could do so, whether it was not possible to reduce the rate of premium charged to electric light companies. We accordingly issued a circular to our policy-holders (we had a great many throughout the United States) asking them to send us copies of their regulations for the guidance of employés in carrying on their work for our consideration; and we told them that we contemplated submitting those regulations to an eminent electrical authority with a view to his considering the same, and from them formulating a set of simple regulations which might have the effect of minimizing the dangers surrounding the operations of electric light men. We received many replies from companies, which stated that they had no regulations of the kind at all. Others sent us their regulations, but we found that they did not cover the whole ground. Others sent us on some very nice regulations. The result was that we found that there was no general kind of action existing among electric light companies on this subject. Therefore, it was with a great deal of confidence and hope that we submitted all these regulations, and the matter generally, to Prof. Morton for his consideration. He has drawn up the set of regulations which have been read, and we consider them very good. We also requested him to write a paper for the consideration of this Convention. Our reason for doing that was this, that we thought that there would exist at this Convention what might be called the concentrated essence of the wisdom of the electric light companies; and we felt perfectly sure that every one connected with electric light companies had the matter of protecting their workmen fully at their hearts, and that if it was pointed out to them that by adopting a few simple regulations they could prevent human suffering and prevent the sacrifice of lives, there was no doubt that they would readily join with us in this matter. Now, as Professor Morton says, possibly these regulations are not complete; but he thinks that among you gentlemen you may be able to suggest amendments or alterations which will make them thorough and complete in every respect. I therefore ask you on behalf of my company if you will kindly take those regulations into your best consideration, and if you can aid us, either individually, or as an association, to complete these regulations, we shall think it a great favor, and you may rely upon it that when they are adopted and brought into use we shall take very close watch of the result of them; and if the result is what we anticipate it will be, there is no doubt it will be followed up by a reduction of premium. (Applause.)

The PRESIDENT: The subject is now open for general discussion.

Mr. FRANCISCO: I would like to ask Mr. Freathy for some information with reference to the prices that he charges electric light companies, and how he classifies the workmen. In what class do you put electric light men at the present time? How do you class them—as ordinary, extra hazardous, or special?

Mr. FREATHY: We have no classification of that kind. As I stated, we started out to fix a rate, but in consequence of the cost of taking care of the cases that occurred, we have been compelled to increase that charge by nearly 100 per cent.

Mr. FRANCISCO: Suppose that I want to insure my men to-day; what would be your price for insuring my dynamo men?

Mr. FREATHY: You do not quite understand the system of insurance. We do not insure the workmen of electric light companies.

Mr. FRANCISCO: You simply insure the employer?

Mr. FREATHY: We insure the employer.

Mr. FRANCISCO: You spoke as though you would charge the workmen a certain price.

Mr. FREATHY: I think I did not say a word about the workmen.

Mr. FRANCISCO: That is why I could not quite get the drift of your remarks. Now, on the employers' basis, how do you classify those?

Mr. FREATHY: We do not classify them at all. We simply charge a rate.

Mr. FRANCISCO: How do you compare that rate with the rate for other manufacturers?

Mr. FREATHY: The rate is high, and we consider that it is higher than it ought to be.

Mr. FRANCISCO: Suppose that I insure my own company with a view to protecting the company against any claim which can be brought for accidents to workmen, what would be your price as you stand now?

Mr. FREATHY: The premium is based upon the wages or upon the payments. We should charge one dollar and a half per cent.

Mr. FRANCISCO: As I understand this electric light insurance business (I having been in the business for some time, and have spent some twenty-five years in the insurance business) I find from his statement that he charges a dollar and a half to insure me against any claim that my employés may make. I have been running a station where for five years we have not had an accident of any description. Why should we pay for protecting ourselves against the claims of these men nearly double what other manufacturers would pay for the same privilege? That is what I would like to have explained. It is a fact that I can insure a quarry company, employing a thousand workmen, for less than half what you say you would be obliged to charge me for protecting the employés of an electric light company. In the quarry the men are certainly exposed to very great dangers; and several of the quarry men have been killed during the very time that our station has been running with no accidents at all. I claim that if a station is properly prepared, and the lines are properly run, there is no more danger in running an electric light station than there is in any other ordinary business; that is, in any business where you would classify them as an ordinary risk. Why, therefore, should electric light men and electric light stations be called upon to pay additional premiums, just as they were by insurance companies on account of extra hazards, when really, if things are properly arranged, there is no such hazard? There is no danger of that kind if the wiring and everything else is properly done, or no more danger than there is in any other business. Of course, accidents will happen in every kind of business; but I am speaking now of the general risks. He says in this report that about 16½ per cent. out of the 91 cases were caused by accidents. Why should electric light men pay for 91 per cent. when there is only 16 per cent. needed by their occurrence? Why should we charge the whole liability off to the electric light department, instead of giving them the benefit of low rates? I am practically interested in this matter, because I have men employed there that come under this very point, and if it is such a dangerous piece of business I am liable to be called upon any day to put up for injuries received by the men, and not only that, but I am under contract at my place to protect that place absolutely from all dangers of every description occasioned by my works, whether to the men, or to the premises. As a matter of course if we have to do that we want to protect ourselves by insurance, and we feel that we ought to have a rate commensurate with the risk and which would give us the same benefit which others derive from the business. (Applause.)

Mr. ALEXANDER: I offer this resolution:

Resolved, That it is the sense of this Association that a copy of the rules prepared by Professor Morton, as embodied in the paper read before the meeting to-day, ought to be conspicuously posted in every electric light station.

The resolution was seconded and unanimously adopted.

Judge ARMSTRONG: Inasmuch as my company has insurance for its employés I was interested in the statement that was made, and particularly interested in the statistics that were given in the paper read before us. I don't know whether it is at all possible for us to make such reports to this Association as will assist the various companies giving employés Assurance or not; but if it is I think we ought to do it. For over five years we have operated our station and have had no accident of any kind, with but one single exception. I believe that the door of the boiler room fell down on one of our employés and hurt him somewhat, but you would hardly charge that against the electric light station. The company insuring us told us last week, when our policy expired, that they would require double the amount of premium that we had paid, being an advance of one hundred per cent.; but, so far as I have been able to see, there has been no warrant for that increase in the accidents which actually have occurred; and the report made in this paper fully justifies the conclusion that I reached. A representative of the company says, however, that because of the ignorance and the prejudice concerning this very subject the companies have been compelled to pay largely in excess of what they ought to pay. Now, it strikes me that on such grounds there can be very little justification in raising the rate as it has been raised upon us, but still the rate is raised. We, who wish to be assured, must pay that rate. If, by the observance of these rules, the sixteen and one-half per cent. can be further reduced, then it is well; if, however, by a careful examination by the officers of this Association, and by a careful report from every company and member of this Association, it can be shown that the accidents in electric light stations are less proportionately than in other stations, merely because the men are more careful, dealing as they do with dangerous things; merely because the men are more watchful, having, as they do have, graver responsibilities, then we ought to have the full benefit that other companies get in their insurance. The quarry men that Mr. Francisco speaks of are certainly in much greater danger than are the men who are employed in electric light stations. I think that every man connected with an electric light company will claim that, and can successfully maintain it. Therefore it seems to me that if by any suggestions that can be made here—how it shall be done I cannot now suggest—but if by anything that we can do we can give full and accurate reports of every accident and of every difficulty that occurs in all our stations, so as to convince these assurance companies that there is very little danger to employés, we can in that way do a great thing and a good thing for our companies. I would be glad to see a proper committee take that matter in charge and devise some proper means for carrying this into effect; and I presume that within the range of what the Secretary can do he will gladly do, with such assistance as the members of the Association can render.

The PRESIDENT: It will be entirely competent and within the scope of the duty of a standing committee which we have, the Committee on Data, to inquire into this matter and report at the next Convention, if the Convention choose to order it done.

Judge ARMSTRONG: That being the case, Mr. President, I move that the Committee on Data be requested to examine into and report all accidents happening in electric light stations, and to what they may be attributed.

The motion was seconded and carried.

Mr. SEELY: Mr. President, before you close the subject of Professor Morton's paper, I move that a vote of thanks be extended to Professor Morton for his valuable paper and that the Secretary be instructed to print the same in the proceedings.

Mr. STORKE: I second the motion. Carried.

The PRESIDENT: Of course the Secretary is instructed to present a copy of the vote to Professor Morton. Mr. Cutter, of Chicago, will now present the report of the Committee on National Insurance Rules. (Applause.)

Mr. Cutter read the report as follows:

Mr. President:

GENTLEMEN: Your committee have at this session simply to report progress, as the object for which it considers itself appointed has not been completed, viz.: the codification of a set of rules regarding electric light and power installations which shall become national in character, and be used instead of the many sets of rules put forth by the different insurance associations throughout the country.

We have written the following letter to many insurance associations throughout the United States:

CHICAGO, Ill., April 8, 1890.

DEAR SIR: At the last meeting of the National Electric Light Association in Kansas City, a committee was appointed to select delegates or representatives from the different insurance associations in the country, and also from the electric light companies, to a national electric insurance committee. This committee will probably consist of eleven or thirteen members, the majority to be insurance men. They are to devise a set of insurance rules concerning electric light installation which shall be enforced all over the country. It is found at present that different rules are in force now in the different parts of the country, and in many places two sets of rules, more or less conflicting, cover the same territory. We hope to remedy the evils of this by devising one set and have this set supported by insurance men throughout the United States.

In order to have these rules the best for the purpose, they should represent the average opinion of the various men who have had experience in this particular line, and also who represent the different interests now involved. It is our aim to get a committee thoroughly well balanced as to the conflicting interests, so that the resultant opinion of them all will be so strong an expression of the best methods for electric work as to meet the support of all the insurance people and the electric light people also.

We wish you would name your choice as a representative upon this committee. We are already accumulating a great deal of information on insurance rules all over the world, so that when this committee hold their meeting they will have the work so far advanced that a good set of rules can be arranged without very much delay.

As there are many electric light inspectors who have had valuable experience and understand the subject pretty well, whom we expect to have upon this committee, we feel that such committee will be a great benefit both to insurance and electric light interests. It is our ambition to have this committee so carefully selected that it will become a body of reference to settle all important questions arising in relation to proper electric work. We trust you will realize the importance of this, and give it prompt and careful attention, and be prepared to support the decision of such a committee.

Hoping to hear from you soon, and to have your support in this valuable work, we remain, Very respectfully yours,

GEO. CUTTER,
Chairman Insurance Committee, N. E. L. A.

The answers to these letters were almost universally favorable, and contained many expressions of appreciation on the part of the insurance people of the efforts made by this Association to work in harmony with them in devising these rules, and in advancing information leading toward good and safe construction.

You can, of course, readily understand that it has occupied much time and correspondence to determine just what associations to approach, and how to approach them, and get them to fully understand our object in order that they should send a representative to act upon this committee. As a result of this work we have the pleasure of informing you that many gentlemen have come to Cape May as representatives of various associations and companies.

These gentlemen have been in session most of the time for several days discussing the different rules, and laboring to outline a frame-work, so to speak, or what they term generic rules. It was the general feeling that these rules should be made concise, and as few as possible, and still cover the basic principles of good work.

Your committee have the pleasure of stating to you that the insurance representatives were quite generally imbued with a feeling of good will toward electric light and power installations, and they do not feel afraid of them.

The deliberations upon this set of rules have been referred to a sub-committee for further study, both to eliminate any mistaken positions, and also to frame them in proper wording.

They have also taken the necessary steps to communicate with one another for the purpose of arranging these rules so they can meet the approval of the different representatives and be adopted in place of the rules now in force. It is the opinion of these gentlemen that this work will be accomplished, and that they will enable your committee to report to the next meeting of this Association the uniform set of rules that you have wished for, and also that they will be supported by the various insurance associations.

It was voted at the last meeting that we should express to you their appreciation of your efforts to work in harmony with them in this direction and assure you of their good will and reciprocity of feeling in the same line.

Your committee have also corresponded with various European authorities to learn their methods of inspection, and also to secure copies of the rules they have in force, and we have in our possession various sets of rules from England, France, Germany and Italy, and these sets of rules with their accompanying information will probably influence to a considerable extent the rules which we will adopt. The force of this can be especially appreciated by noting part of the report of the committee on lighting, heating, and patents, appointed by the National Board of Fire Underwriters, which report was presented to the National Board last winter.

And then to show the opposite opinion held by insurance companies in Europe, as well as many in this country. The Phœnix Fire Office Rules of London were issued in 1882, and their edition of 1889 contains the following statements, viz.: "Notwithstanding the number of years that these rules have been in force, not a single fire has yet occurred from any electric installation that has been placed up in compliance with them. The electric light is the safest of all illuminants, and is preferable to any other when the installation has been thoroughly well put up."

The electric light and power interests are of great importance in Italy, and the only rules in force in that country are those established by the government to protect its telegraph and telephone circuits. There are no insurance rules in Italy, and no insurance inspection of electrical installations, and places lighted by electric lights have the benefit of a diminished rate.

The great problem before us to-day, however, is the management of the various systems of electric lighting so as to ensure safety from fire. When such lights were first introduced underwriters congratulated themselves that at last the long sought means of illumination without danger had been found. No matches, no kerosene explosions, no swinging gas brackets would hereafter vex them, but a steady, safe and brilliant light, which could do no possible harm, had come among us and all were happy.

It did not take many months, however, to discover that the electric light was not the harmless thing we had imagined, but that it was a most prolific source of danger, and its introduction has cost the insurance companies more than any method of lighting heretofore in use. It has come to stay, and some time it will probably be as safe as any light in use, but our knowledge of its properties and of its management must be vastly increased before that time appears. We see the danger, but as yet are too ignorant to point out the remedy. What yesterday seemed a safe method of installation to-day proves dangerous, and what we regard as safe to-day is likely to develop danger to-morrow. We can only wait and study.

For a number of years the National Board has followed the action of the New York Board in the matter of rules of regulating electric light equipments. Those rules were revised and re-issued by that Board January 15, 1890, and it is recommended that they be adopted by this body as thus revised, and promulgated to members.

In this connection, it is proper to say that the National Electric Light Association, in a letter appended to this report, asks the National Board to nominate a representative upon a committee to be drawn from bodies of underwriters and electrical experts in different parts of the country, to devise and recommend rules for electric light installations, which shall be uniform throughout the land and tend to throw safeguards about the use of such lights. Your committee recommends that the invitation be accepted, and a representative appointed. Certainly, nothing but good can come out of the deliberations of such a committee, and it is necessary that we should in every way increase our knowledge of what has become so important a factor in our business, and if possible remove some of the dangers now attending it.

Precisely what is expected of this committee in regard to the third topic named in this report, viz., "Patents," they are unable to say, but nothing in this department has been brought before them which seems to require any report

In conclusion, gentlemen, your committee respectfully ask for more time to complete their work.

Mr. BURLEIGH: I move that the report be received and filed and the committee continued.

Mr. SEELY: I second the motion. Carried.

Mr. DUNCAN: There is a statement made in that report to which I desire to call the attention of the Chairman of that committee: that the committee place themselves upon record as making the statement to this Association that electric lighting up to the present time is the most dangerous illuminant in this country; and in the latter part of the same report, since 1882, in England, they make the statement that it is the safest illuminant in the country. Is that correct?

Judge ARMSTRONG: That is a quotation.

Mr. DUNCAN: Where is the quotation from? That is what I am trying to get at.

Judge ARMSTRONG: The National Board of Underwriters.

Mr. DUNCAN: That is the insurance standpoint. The last statement made is based upon what?

Mr. CUTTER: That is a quotation from the last edition of the Phœnix Fire Office Rules.

Mr. DUNCAN: In other words the two statements upon which the committee's report stands are from two standard authorities upon insurance matters, one diametrically opposite to the other. That is the point that I want to bring out before this body to show you that while we are organizing a committee, as I understand by that report, the majority of whom shall be constituted of insurance men to consider rules which shall be formed and referred to this body for adoption, yet upon their own statement in different countries they present diametrically opposite views. I hope therefore that this committee, in its pursuit of facts and in its pursuit of knowledge, will so sift the insurance statements that when they come before this body again they will be able to say from their own standpoint what are facts and what are not.

Mr. ALEXANDER: Mr. President, perhaps the reason why the Phœnix rules show such good results is because on the very first page is printed a very terse sentence and very much to the point. It says, "In examining your tenders for work from different electric companies be careful not to accept the lowest tender until you have thoroughly examined all and find that the work will be done just as good at the lowest figure as the highest given." This short sentence, or one using similar language, is printed on the first page, and owing to that, perhaps, they have had such good results with their rules. (Applause.)

Mr. BARTON: Mr. President, there seems to be a little bit of misunderstanding on the part of my friend Mr. Duncan in relation to the quotations in that paper. It has become to my mind so chestnutty that it is hardly worth replying to. The report of the National Board of Underwriters which was quoted in the paper is the most assinine conglomerate mass of stuff that I ever read. (Laughter.) I have taken the trouble to express myself upon the subject, and those who can read have had an opportunity to read. My friend Mr. Foote has done the same. The whole basis for the statement made in that report was founded upon the supposition, upon the assumption, that the one great fire in Boston last November was due to electrical causes; and, Mr. Chairman, there is not a shadow of foundation for that assumption (applause)—not a shadow; and I make the statement boldly, and challenge any refutation of it. That fire cost the insurance companies something like three and a half or four million dollars. It swelled the loss in a certain statistical paper that was published here in this country as to fire losses—it swelled the losses of those tables chargeable to electric lighting more than 500 per cent.; still it was only one fire, only one incident, and that one incident was without any foundation of authority. These are the facts: The number of fires which occurred last year was only 73; the number of reported fires I would say, from electrical causes, was only 78, as compared, I believe, with 119 the previous year for the whole United States. The number of fires actually 25 or 40 per cent. less; the amount of loss attributed to fires 500 per cent. greater. And, as I have repeatedly made the statement, if that kind of reckoning is fair and right, why, then you may fairly say that a cow and a lantern are the most prolific source of danger that is known, because they burned up the city of Chicago, with $200,000,000. (Laughter and applause.) I do not think it

is necessary to say anything further. The whole subject of the National Board of Fire Underwriters of New York is not worth talking about. I am ashamed of my profession that ever such a report should have emanated from it. (Applause.)

Dr. Mason: Mr. President, this seems to be a case where, more than any of which I have had knowledge, the doctors disagree. It does seem to us as if the insurance people had not much confidence in each other's judgments. (Laughter.) An insurance man characterizes the report of the largest insurance organization perhaps, in America as "assinine," and we are all cheering him; and, if it will be taken in the pleasant way in which I speak of it, I rather think it is a fact that insurance men hugely enjoy disagreeing with each other. I rather think that our good friends, the gentlemen who represent the insurance companies, who have been making rules for us, think each other to be considerably long-eared; at least I have had a suspicion that they did, and I have sort of pitied my good friend, the chairman of this committee, who has had to sit while these fellows have been around—that committee which he has called together. I have wished that I might have been in and seen what sort of a managerie it was. I looked in the door but I was frightened and got out. (Laughter.) Now Mr. President, I have this thought coming over me: We appointed a committee last year, the committee of which Mr. Cutter, the chairman, has just made a report. We had a more or less definite thought in our minds as to the scope of that committee's work. They have done a work undoubtedly valuable and one that must live and must go on. Yet I have been questioning whether this Association does not want to do something itself and of itself; whether it does not consider itself perfectly competent to do that work; and I have thought of formulating something like this, for instance, taking it for granted, if I may, that this body desires to express itself on this matter of rules: "*Resolved*, That this committee be instructed, having heard from"—I cannot call it a sub-committee, but this large committee which is to consider rules—"having heard from them, that our committed be instructed to give us independently a set of rules which it recommends"—whether they be the same that shall be adopted, or whether they be changed less or more—"that they give us a set of rules which they can recommend, and we will consider them here." I offer that as a resolution. I will put it in writing, if you please, afterwards.

Mr. Alexander: Mr. President, in the interest of fair play, I want to say that there are several gentlemen here who have come many miles, insurance men, who do not consider that they have a right to the floor, being merely here on complimentary tickets. The gentleman who has spoken, Mr. Barton, is a member of the Association. I think it would be merely fair play to permit these gentlemen to express their ideas. The Secretary of the National Board unfortunately has gone off this afternoon, before this report was read, and is not present. I see other gentlemen present, insurance men, who are well able to take care of his side of the question. But before you call upon them I want to say that I have found these gentlemen, not as Dr. Mason has described them, when I sat with them three long days, but rather inclined, many of them, I will say, inclined to do the best they can in our favor. In fact, one inspector said this—and he is an inspector well known, Mr. Goddard, of Boston: "If you and Mr. Jenks and Mr. Lovejoy say that my rules are wrong I will consider that they are wrong unless I can present an argument and convince you that I am right, because you have had experience in the business which I have not had." I think this is a very fair statement. I have heard two or three other gentlemen express a similar statement. They said: "We want to do the best we can." Some of them were electricians; some were inspectors; but the inspectors that were there always all of them were perfectly willing to abide by any fair rules made by a good body of men. I did not intend to speak on the question when the report came up. I have sat with them, and in justice to those who are absent now I think I ought to make that statement; and I hope the President will give the floor to the gentlemen who are present representing insurance interests, and who have come a long distance. I see a gentleman here from Alabama and one from St. Louis who have come here for that purpose.

The President: The motion now before the house, made by Dr. Mason, is that our committee be instructed and directed to report at the next Convention a set of rules which will be, if found proper, adopted by the National Association, and by the National Association recommended to the insurance interests of this country and to all who are installing and using electric light. Does that express the sense of your motion?

Mr. Cutter: Mr. Chairman, I will first undertake to explain to one gentleman who has asked about the contradictory statements. That arose because (it was largely personal) the Chairman considered the report before the National Board as unfair; therefore a consideration of my report will show that I have embodied the statement that the insurance men here have expressed themselves in a different tone, and that insurance people abroad have expressed themselves in a different tone: and our only object in embodying it in our report was simply to put the two statements side by side for consideration. (Applause.) In reality, Mr. Chairman, to show the absurdity of the position taken by the committee of the National Board, that that opinion is not sustained by the insurance people in this country—and I intended to so word my report as to convey to this Association the idea, the fact, that the insurance people that we have met here have given us to understand that they do not concur in that view of the case. That was why we embodied that in the report, and I hope it answers the gentleman's criticism.

Now, in relation to instructing us to devise an independent set of rules to present to this Association, I would like to state that we are not active members of this Association, none of us. It is a labor of love. We do not care very much about how your rules are; we simply want good work; and I, for one, am willing to do what I can towards bringing about that good work. In doing that we have brought insurance people here, twelve or thirteen of them, from different parts of the United States. All told, it represents considerable expense and time lost; and for what? If you tell us to devise a new set of rules and present them to this Association, you thereby tell those insurance people that you do not care for them to continue their work toward devising a uniform set of rules which they will support. If you appoint a separate committee, whether they be active members or not, you take practically the same position, and you put us in a very embarrassing one, because the insurance representatives have most of them gone home. We have taken the necessary steps to reach them. We have appointed a sub-committee to enlarge and perfect the instructions we have given them, and in harmony with what they supposed to be the wishes of the National Electric Light Association. Your committee, to speak candidly, felt itself toward the last of the deliberations in a very embarrassing situation, working here and not being members of the Association, and not knowing whether they would be supported or not. We could not complete our labor, therefore, in order not to block the work we made our arrangements with the National Electric Insurance Committee, so-called, to hold itself together—and your committee of five are upon it—to work out this set of rules; and in my report I have said that we hope to present them to the next meeting of this Association for your approval; to do as you please with them; and also with its statement that those rules will meet the support of the insurance people. When they come before you at the next meeting we believe you will not have to refer them again to the different insurance people for their approval. Therefore, if I have made myself understood, I hope this Association will appreciate the fact that it is a labor of love on our part, and we only ask you to let us stand over and we will do the work.

Dr. Mason: Mr. President, I wish I might be permitted the courtesy to say a word in addition to what I have said. I think there is not a member of this Association but appreciates the work not only of Mr. Cutter, but of those who are joined with him. They have done a grand work and it must result in good; but one point I make is this: I hope the pleasantry in which I indulged regarding insurance people will not be taken as serious. It may go for what it is worth; it is not worth much. But this I am very serious upon. Here is a committee which is not responsible to us, and which will do doubtless a very valuable work; a work which may or may not live; I trust it will live. One thing is sure; this Association appointed a committee because it wanted to adopt certain rules, and it is competent to do it. Whether insurance people like the rules afterwards or not is a secondary question. Now my resolution looks simply to this: that our committee shall, if they believe that the rules that shall be formulated by this larger body are the best possible, present them to us; if not, that they will make such changes as their independent wisdom suggests; but that finally we shall have a report to us of our committee of rules which the Electric Light Association may consider and upon which they may pronounce, absolutely independently of any and all other organization. That, I am very sure, is what the Association intended, and my impression is that is what it wants, and that my resolution looks to certainly. I hope no disrespect will be assumed toward the chairman of this committee or the gentlemen who have acted with him.

Mr. Barrett: Mr. Chairman, I have had the honor of representing the Board of Underwriters, of Chicago, at this meeting, and I found there some of the ablest men in the profession of inspectors in this country or any other (applause) willing to work and co-operate with this Association for the purpose of the common good. One of the great difficulties with which we contend in this country is the various rules set down in different parts of the country; and the great purpose of this meeting, as I understand it, was to harmonize those rules and to get a set of rules for inspection and installation. I understand that this report, when finally made, was to come to this Association and receive its approval or rejection. They have arranged to receive reports from all parts of the country, and I would be sorry to have this arrangement disturbed until the next meeting of the Association so that we may have an opportunity to lay something before them.

Mr. Alexander: Mr. President, I have a few words to say on this, because I am very much interested in this insurance subject, and I have for years past worked on it very hard. All these gentlemen interested in it I know will stay here and listen. Now we have discussed it three days, from early morning to late at night; we have discussed it at the dinner table and on the beach, while walking and while bathing, and for days before you came here we had nothing under consideration but this important matter. I hoped myself that we would bring in here a set or rules. What I want to find out here is just the question that Dr. Mason asked, who are that committee? I find in the printed report of the Kansas City Convention no mention made of any committee being appointed, but simply a resolution to appoint; and that resolution is to appoint a committee of five, which in turn shall appoint three electric light men as a committee of conference.

Even if it had been forgotten—if the President had forgotten to appoint such a committee (I don't know how it is now), I don't believe candidly that there is anybody on that committee to-day but the chairman. And then, gentlemen, where do we stand? Let us understand this, and let us settle it right here who are on the committee. As I say, there is a committee of five, that in turn may appoint three men, and those three men may concur. Those three men and the insurance men are the standing committee, whatever you may call it, and the National Electric Light Association has nothing whatever to do with them; and that has been expressed by the gentlemen who have met. It is an entirely outside affair, and, therefore, I should like to see Mr. Seely's motion go through recommending the appointment of a committee of the National Electric Light Association. (Applause.)

Mr. Duncan: Mr. Chairman: My tendency to stir up the insurance people has created a great deal of fire. We are getting information here this afternoon that is valuable. We were on the eve of passing a report creating a bureau outside of this body which should not be responsible to us, and creating it as a committee, the majority of whom are outside of us, to throttle either us or somebody else; and by an intuitive sense which came to me I asked the question for information whether this report before us now was being cared for by any organized body of our own. From the statement made by the gentleman who has just preceded me we have arrived at the conclusion that for an hour and a half we have discussed a report which was never authorized by or belonged to this Association, if that statement is correct. I take the statement as being absolutely true that there is no such committee on the record If the Secretary knows differently, it is his duty as an officer to get up and say so. Silence gives consent, and we are therefore discussing—

Mr. Cutter: I will explain about that committee if you will allow me. I can, perhaps, save the Secretary some trouble in finding the record of it. The resolution was passed at the last moment of the meeting at Kansas City. The committee was not appointed at that time; the President had not the time, and therefore it was appointed by the President later on, and we received our announcements afterwards; and if the report has been published without the names of the committee, that is not an explanation of it. The committee consists of Mr. C. J. Field. Mr. T. Carpenter Smith, Mr. S. E. Barton, Mr. H. Ward Leonard and Mr. Charles Cutter.

Mr. Duncan: I am very glad to know that we have a committee and that the committee has performed its work, and I believe they have done it well (applause), and while I thank that committee for working so disinterestedly, not having any standing in this Association at the same time I cannot refrain from remarking that it seems rather remarkable that on an issue which is so important to electric lighting and central stations, and in which such a large amount of capital is invested, that the committee should report and yet have no standing practically in this body. It is for that reason, this discussion having gone on from one point to another and having brought that out, that I shall support the motion of Dr. Mason to put this in the hands of a committee of this body, so that we shall be responsible for it and approve it, or we will not. Is that Mr. Seely's amendment? As I understand it, that is for the appointment of a committee of this Association who shall make independent rules and submit them to us for approval or disapproval.

The President: Mr. Seely's amendment was to create a new committee and direct them to report. The point of order was raised that it should be necessary to move a discharge of the old committee first. The Chair sustained that point of order. The motion now is to instruct these gentlemen who are named as our committee to report to us at the next Convention a set of rules.

Mr. Alexander: I want to say to the President that the old committee, under the resolution, is a committee for harmonizing the electrical and insurance interests; and the amendment is for a new committee to form rules.

The President: The one is the title of the committee; the other is the substance of the resolution. The substance of that resolution was that you should report a set of rules. I have it right here. The substance of that resolution is rules all the way through; that is the one thing.

Mr. George Cutter presented these resolutions at the Kansas City meeting, which were unanimously adopted:

"*Whereas*, It seems desirable that underwriters' rules, governing the installation of electrical apparatus for light and power, should be the same throughout the country, and that they should be as plain and concise as would be consistent with their efficiency, and

"*Whereas*, In order to secure the formulation and adoption of such rules, it seems necessary that the authority be vested in a committee composed of representatives of all parties interested; therefore, be it

"*Resolved*, That the chair select and appoint a committee of five members of the National Electric Light Association, who shall have power to choose three representative electrical men to act on a committee for the purpose of devising and adopting national insurance rules and considering any other matters affecting the joint interests of insurance and electrical companies; and be it further

"*Resolved*, That the committee of five be requested and authorized to negotiate with the various general insurance organizations throughout the country, with a view to securing the appointment by them of representatives on a national electric committee, and that the committee of five report the result of its deliberations and actions at the next meeting of this Association."

Mr. Barton: Mr. President, I think I know something about that resolution that was passed, and if this committee which Mr. Cutter is the chairman of has not fulfilled its duty and made its report to this Convention, then I don't know what the fulfilling of the duty of a committee is. I don't think you will find, Mr. Chairman, in that resolution anything requesting or directing that committee to bring in a set of rules. It was authorized to confer with the representative insurance men with a view to negotiating or agreeing upon a set of rules that should be unanimous and should be operative through the country. I have had the pleasure, and perhaps I may say the discomfort, of serving on that committee for the last three days, including Sunday, and I know that we have accomplished excellent work. We have had an excellent representation of insurance men. Mr. Cutter has called about him an excellent representation of electrical men, covering all of the interests. That committee has gone to work; it has labored day and night, and far into the night, on questions of rules, without any lack of harmony whatever; it has been perfectly harmonious from beginning to end. It has almost completed its labors. If we could be allowed two or three days more, if the insurance and other representatives could have stayed here, we could have had rules reported to you. My idea is that we have no right to report rules here. I should be dead opposed to reporting any set of rules to this Convention. What can this Convention do with a set of rules? I think you will all agree with me that it is not a comfortable position to be in the soup, but I am free to say we would be there if we brought a set of electric insurance rules into this Convention. Who would know where we stood? We would be a great deal worse than Pandemonium or Bedlam, or anything else

Mr. Cutter: Would we not have to refer those rules to the same insurance people that have met us?

Mr. Barton: I will speak on that a little later on. I believe in independence as much as anybody does. I believe if the electric lighting interests had had it in their power in the beginning to have made their own rules, to have abided by their own rules, to have gone on doing good work in accordance with good rules, irrespective of the insurance interests, absolutely ignoring them, it would have been far better for them; but they did not do it in the beginning. I further say that this National Electric Light Association can never enforce any rules. If it had representatives from all of the people who are installing electric lighting apparatus; if every local company, every central station in the United States, or a large majority of them even, were represented in this National Electric Light Association, firm believers in it and supporters of it, then I would say with Dr. Mason, have your own rules and let the insurance companies do what they please; make rules that are tight and fair and safe, and such rules as you want, and enforce them, and you will be all right. But, unfortunately, that is not the condition of affairs. If you make rules how much of them can you enforce? When it comes down to a matter of fact, the only way you can enforce rules, in the competition that is so fierce all over the country, is by the pressure brought to bear from the insurance interests, and no other. It is the only way that any set of rules, any set of requirements or restrictions can

be enforced; it is through the pressure that is brought to bear by the insurance interests; and why? Simply because their interests are identical, and are brought right in; not because it is a work of love on their part or charity, but because it is dollars and cents with them. I am free to confess it is not so serious a question as some of them believe, because I myself am not a believer in the danger of electric lighting, even with poor work, as some people are; but it still remains that no rules can be enforced without the support of the insurance interests. Now then, this committee that Mr. Cutter represents is nothing but the outgrowth, the continuation of a committee formed because there was a threatened disruption between the insurance and electrical interests; and that committee's name signifies that it was a committee for harmonizing insurance and electric interests. My friend Mr. Alexander was the chairman of it, and he did noble work and harmonized the interests. In perpetuation of that thing, in carrying it on, and in order to do better work, another committee was appointed, of which Mr. Cutter was chairman, and that committee has gone on disinterestedly and has done equally good work. It has gotten together, as I said before, these insurance men; and as Professor Barrett has said, it has brought inspectors that have a national reputation, inspectors that are not influenced either one way or the other, except by the one desire to see good work done; and the result will be a perfect set of rules, and these rules will be in operation before your next Convention comes, and you will be feeling the good results of them; they will be offered to you then, and you will be asked to adopt them; and I venture the statement that you will do it without any objection.

The PRESIDENT: Do I understand the speaker to say that they propose to have them in force before they present them to the Association at all?

Mr. BARTON: They will be worked upon; there isn't any doubt about that. Any good rules will be worked upon, and this Association and no other association can prevent it if they are good rules. If they are right they are bound to be adhered to by those in the business who are determined to do good work. It does not matter whether they get approval or disapproval. If they are right and proper rules they are going to have the support, not only of the insurance men, but of the electrical interest, and they are going right on. And then, I am sorry to disagree with my friend Dr. Mason, and also with my friend Mr. Seely. It will be a mistake if you appoint any other committee; if you set about to form any rules of your own after having appointed a committee for the very purpose, and that committee having done its work faithfully and fairly, and reported to you its progress, and asked you for more time—not an unreasonable thing at all—it has done everything that it was asked to do, namely, to report what it had done at your next meeting; not to report rules; you can find nothing in that resolution asking them to report rules to you. I had something to do with the drawing of the resolution, and I don't think I ever suggested reporting any rules to the Convention, because a convention like this is no place to consider rules of insurance.

Dr. MASON: Do you say they will be presented to us at the next meeting?

Mr. BARTON: Yes, they will be presented, and you will be asked to receive them and adopt them. As I have said before, I venture the prediction that you will adopt them. I think the whole thing is stirred up without any necessity at all. The committee has done its work, has done it well, and you can ask no more; and I trust Mr. Seely will withdraw his motion and that Dr. Mason will do the same.

Dr. MASON: I think the whole object of my resolution has been achieved, and I think I shall voice the sense of the whole meeting if I simply do what I now propose to do. I move that this whole subject be laid upon the table. I think we understand each other, and I think everything will move on as we want it to now. I move that the whole matter lay on the table.

Mr. STORKE: I understand that will be accomplished by the withdrawal of the motion.

Dr. MASON: I cannot withdraw it without unanimous leave. If I move to lay it on the table the matter is not debatable, and it will be seconded, I understand.

The motion to lay on the table, being duly seconded, was carried.

The PRESIDENT: The next thing in the order of business will be the consideration of the subject of the proper classification of the lighting power of incandescent lamps; and the discussion will be opened by Dr. Louis Bell, of New York.

Dr. BELL: I have raised this question for the consideration of the National Electric Light Association because it seemed to me a very curious thing that the whole subject of the classification of electric lights has not been more thoroughly gone into at previous meetings, and that there is now no general accord either in the classification of incandescent lamps as regards their light-giving power, or the methods in which that light-giving power shall be measured. It is rather a singular thing that light should be one of the most difficult things to measure absolutely that we have — not difficult to measure relatively, except in certain cases with which we are unfortunately only too familiar; but it is exceedingly hard to find anything like an absolute standard of light. The last desperate effort of electricians in that direction only resulted in perhaps as impracticable a standard as was ever brought before the consideration of a scientific body. The question of classifying electric lamps is coming to be rather an interesting one, and one that is of importance to those who supply the lamps. We have various sizes and kinds of incandescent lamps of all sorts of nominal incandescent candle powers, the most usual in this country being the 16 c. p. lamps; but is there any common accord as to what is meant by a 16 c. p. lamp? I think not. When the matter comes to be tested we find that there is not. Of the various lamps now in use, rated at 16 c. p. nominally, some give the full candle power called for by their names, others give 10, 12, 14 or 15, and some of them give more than the rated candle power. We do not know, at first sight, whether it is fair to say that a lamp is 16 candle power when its mean horizontal intensity reaches that figure, or when its spherical intensity reaches that figure, or when its hemispherical intensity reaches that figure. That whole question is open, and certainly ought to come under consideration by this body. Then, again, suppose we take one of those particular candle powers to be the standard. For instance: Suppose that we take the horizontal candle power, which is perhaps the easiest to measure, are we then in any better position? It might seem so at first; but a moment's consideration will show that the size, or rather the shape, of the carbon filament has a very important bearing on the distribution of the light, and that consequently a light which gives in any one direction 16 c. p. may give considerably less in any other direction. Again, if we attempt to fix a standard direction, as, for instance, a direction normal to the plane of the filament for measuring the candle power, we again get into trouble, for the reason that while the filament of a circular section gives a nearly equal distribution of light, a rectangular filament necessarily, theoretically and practically gives an unequal distribution, the maximum intensity being at 45 degrees off the plane of the filament, or thereabouts. So that looking at it in any way we like we find that when we are speaking of a 16-c. p. lamp, we may or may not mean the same thing. With the arc lamp we unfortunately know that the case is even worse, for instead of having an approximately equal intensity throughout a reasonable range around the lamp, we have a maximum intensity in a zone perhaps 20 deg. wide and reflected 45 deg. below the horizontal plane of the arc. Furthermore, we know only too well that the nominal candle powers of arc lamps are quite different from the real. The whole subject is in a tangle which at first seems almost hopeless. Heretofore it has not been specially important in the early stages of electric lighting, because people did not look so closely then into the exact conditions under which the light which they purchased should be given; but as the electric lighting business comes more and more down to close competition and hard commercial lines, it becomes more and more necessary to look after these things, and to define just what we mean by the lights which we contract to furnish, and to arrange some way by which there shall be general consent as to the meaning of the terms which we use. I am happy to say that, as most of you know, the practice abroad tends towards something quite different from the candle power measurement; it tends toward the selling of electric energy by watts, even when it is furnished as light—the kilowatt hour being the British Board of Trade unit; and it is a question which I think we should take up, whether it is not perhaps advisable to classify by watts, a quantity which can be measured with the greatest ease, instead of by candle power, a quantity which is only measured with extreme difficulty. I pass over for the time being the difficulties in actual photometric measurement depending upon the difference in color, as they are subsidiary; but the great question seems to be to find some one definite thing which we can all agree to call a lamp of a certain size, whether it be 16 candle power, or 60 watts, or whatever you please to call it. Of course certain objections to the watt classification instantly arise, and among them is the possibility that it may tend to develop a type of lamp which will not be quite as efficient as those which are now generally used. That of course is simply a possibility, but it is one of the things that we want to bear in mind, for, objectionable as candle power measurement may be, it is not well for us to be blind to the difficulties that come up with any other form of measurement. I desire to bring this subject prominently before the National Electric Light Association, because it is one in which I have felt a great deal of interest, and which I have had occasion to study somewhat, although perhaps more from the scientific side, in the matter of photometry. I believe it is a subject which calls for action on the part of the Association as a body, because I think the time is coming, and is in fact now here, when some such definite standard of measurement is needed, and should be had; and this is the only body that has the power to make and to enforce any classification of light which may seem desirable after a consideration of the whole subject. I think that it is a case for action by the Association, and that it should take measures that shall lift us out of the very puzzling difficulty into which we have fallen simply through negligence, and through no fault or intent to deceive; but merely because the whole matter has been allowed to slide, and everybody has gone on in his own particular way, instead of having, as we must soon have, something definite, something exact, something perhaps not scientific, but something which shall be at least empirically definite. (Applause.)

Mr. GARRATT: It must be a matter of pleasure to all of us to have this subject brought before this Convention. There certainly is no one thing which has caused so much aggravation to the soul of the average electrician as the effort to find some basis on which you can talk about the candle power of lamps. The trouble with trying to establish in America a practice similar to that of the Board of Trade in London is the fact, which we might as well recognize, that the National Electric Light Association cannot enforce anything. Some years ago I made no less than 500,000 figures for this Association to enable it (I was requested so to do) to measure wires. I made enough figures to reach from the city of Boston to the city of Providence. But, after having made those figures, and after they had met the approval of a majority of the members, we found that we were totally incapable of making anybody use them. Now, there certainly can be nothing better—or at least it is the opinion in England, and I think it is of the majority of the men in America—there is certainly nothing better for the unit of incandescent lamps than the kilowatt hour, provided there is proper precaution taken that the makers be not led to turn out a lamp which may possibly not be as efficient as the customer ought to have. Taking the kilo watt hour as the unit of energy for each lamp and fixing the length of the life of the lamp would seem to tie up our friends, the lamp makers, pretty tight, with regard to what we should call a 10, a 16, or a 20-c. p. lamp. It is quite impossible to make the purchaser of the lamp, the householder, ever talk about kilo watt hours. They will purchase what they know as a candle power lamp. But this Association might very properly suggest to the manufacturers of lamps that a 16-c. p. lamp, or a 20 c. p. lamp should absorb so many watts; and the unit of charge to the customer might be based upon watts as against hours. That might, perhaps, be best brought before us in proper form by the action of a small committee who could bring the subject before the next meeting of this Association in a paper, and if it is satisfactory to the body it might then be recommended to the lamp manufacturers. It is a thing which I do not think the general public will do very much with; and I do not see that it is a thing which the National Association can very well enforce. But I am positive that the kilowatt hour would meet the approval of all the electric light fraternity in the country.

Mr. ALEXANDER: Not many years ago I attended a lecture given by a gentleman on incandescent lamps. He was a very learned man indeed. He told us all about incandescent lamps; and in fact he made one statement and it is that particular statement that I want to allude to—that in order to give a certain efficiency to a lamp the carbon should be of a certain structure, the carbon filament should be of a certain structure, and should be .9188 of a millimetre in thickness. I was talking about it with a gentleman who was very much interested in the subject; and he illustrated several facts with a great many equations, like $YZ = D^2 \times X$; and he had it all printed for the edification of his hearers, and I had it in my hand, and looked at it hopelessly and put it in my pocket. I commenced to say that when he mentioned that the carbon filament should be .9188 of a millimetre in thickness I was reminded of my youthful days, when a man was pointed out to me who was quite a genius; that gentleman had a grease-spot on his coat, and he immediately went to studying chemistry to see by what means he could best get that grease-spot out of that coat without injuring the texture of the fabric; he studied day and night for two years, until he finally got it; but when he got it the coat was all to pieces, and he could not wear it. It is not a scientific lamp or a laboratory lamp that you want; it is a commercial lamp for every day use. When Dr. Bell brought up this subject (which is certainly a very interesting one) I thought at first, why don't you speak about the candle power efficiency of the arc lamp? There is certainly much more variation between the so-called 2,000 c. p. of the arc lamp, and its actual power, than there is of the incandescent. I recollect a measurement made three or four years ago by which it appears that a 2,000-c. p. arc lamp varied from 134 to 1,386 candles, according to the measurements made then; but still they were all called 2,000 c. p. lamps.

The PRESIDENT: I shall have to call the gentleman's attention to the fact that we are discussing incandescent lamps.

Mr. ALEXANDER: I am coming to that directly.

The PRESIDENT: I hope you will come to that at once, and stay there.

Mr. ALEXANDER: I only want to ask why you do not measure your arc lamp by watts, and why you measure your incandescent lamp by watts? The efficiency of the lamp to the consumer is of the greatest value only in some cases. If I have a water power to run my central station, as the power does not amount to anything, I do not want an efficient lamp, but I want a long-lived lamp; but when I use coal at $5 per ton I want a very efficient lamp. It is a fact that I have had from one railroad company a letter in which they asked me for a very inefficient lamp, because it costs them more to move their storage battery in and out of the car than the breakage of the lamps amount to. They have by figures furnished by their electrician shown that a very short-lived lamp, say a lamp that lasts them but 100 hours, is cheaper than one which lasts them 600 hours, but needs a great deal of current. In measuring lamps Dr. Bell has no idea but that we can measure a lamp very carefully and nicely, and then put it in as an actual 16 c. p. lamp; but when he will consider that in manufacturing, three little girls who are paid from $4 to $7.50 per week have to measure from 2,000 to 2,500 lamps on a photometer per day, he will see that a commercial lamp has to be made at a price that the central station would not want to pay if every lamp was figured right down to the one-hundredth or one-tenth of a candle power. It is impossible to do it. In the lamp with the twisted filament, as you know, the light can be measured upright, and you get an equal diffusion of light, while in another lamp you would have to make, of course, two measurements; and the mean measurement of these two ought to be sufficient and come near enough to the actual measurement of the other lamp with the twisted filament to offset any commercial distinction. This matter having been brought up in this way, I thought that I ought to explain the difference between the laboratory lamp and the commercial lamp with some care.

Dr. BELL: I am not speaking of the laboratory lamp at all. I am speaking of the practical commercial lamp with which we are to deal. I am not asking Mr. Alexander or any one else to make a lamp which shall be exactly one hundred candle power; I only wish to have our incandescent lamps certainly classified within twenty-five per cent. of their proper value. We do not have to go far to find lamps put out on the market as sixteen candle lamps, which do not give efficiently thirteen candle power. That is the kind of efficiency I am talking about, and not about any question of measuring the hundredths of candle power. What do we care about hundredths of candle power, or what do we care about a difference of one-half a candle power in different directions? If the difference rises, as it sometimes does, to be 4 or 5 c. p. in different directions, then it is something that we ought to take cognizance of. I am not speaking of laboratory tests, or of laboratory lamps; I am speaking only of practical commercial incandescent lamps. The question of arc lamps I felt tempted not to touch upon for the reason that we have not been in the habit of measuring those anywhere in the world by the watt. The incandescent lamp is supplied frequently by meter, and that is what brings the matter of classification into special importance. We all know very well that the arc lamp is a great sinner in the matter of the distribution of light and in the difference between theoretical and practical efficiency; but at the same time we ordinarily do not measure the power supplied to arc lamps in watts, as is getting to be somewhat the custom as to incandescent lamps. I should certainly be in favor of including the arc lamp in any action which the Association might take on this question. I am not here to malign the incandescent lamp. I think it is a matter of wonder that the incandescent lamp is as generally efficient and successful as it is; but I think the time is coming when we ought to come to some definite conclusion as to what we mean when we say that a lamp is a 16 c. p. lamp, and sell it as such, knowing as I do that the lamps now in the market known as 16 c. p. vary rather more largely than even the conditions of commercial service make desirable.

Mr. ALEXANDER: May I just say that I consider that when a lamp is sold as a 16 c. p. light and gives but 13 candles it is a dishonest thing; as to the other question, about selling efficient lamps, that is your business. I saw in New York city the other day bills which were made out by watts, which I considered a very proper thing to do.

The PRESIDENT: I was in conference with a young man representing a lamp concern, and the question came up as to the price and efficiency of lamps; and he said: "It is altogether a question for us whether you sell by metre or

by contract. If you are going to sell by metre, and your customer pays for the lamp, we will give you an inefficient lamp, so that the bill will pile right up on him; but if you are going to sell by contract we will give you a very much more efficient lamp, and you can furnish a lamp that will be much more efficient, and you can make the same money." That shows that the young man who represented the lamp understood how to meet the demands of business.

Mr. STORKE: Will not that be a matter for the executive session?

The PRESIDENT: In making a test of the lamps of six different makers I found that the variation in 16 c. p. incandescent lamps is much more extreme than would be called a fair ordinary commercial average. I found that in two lamps the variation was from 17.25 candles to as low as 6.42 candles, and the watts per candle varied from 3.13 to 8.2 watts per candle.

Mr. GARRATT: Were those all new lamps?

The PRESIDENT: They were all new lamps.

Mr. ALEXANDER: That is a subject that I am interested in; and I want to say that a lamp that will measure at the start 12 or 13 c. p., after two hundred hours will likely give more light than a lamp which measures 17 c. p. at the start. All these matters have to be considered. If I desired to measure and to make an actual test I would measure the lamp after fifteen hours' burning, and then I would get a good result.

The PRESIDENT: We are now going through with tests and measuring every twenty-five hours. I will say, however that a lamp which gave 17.25 candles was the lamp which at the end of 1,000 hours showed the least blackening of any lamp we had, but unfortunately it was not as efficient as I would like to have them.

Mr. COGGSHALL: Were those lamps tested made by one maker?

The PRESIDENT: They were made by six different makers.

Mr. GARRATT: I think that it would be well to appoint a committee of three members of the Association to report at the next Convention on the best methods of referring to incandescent lamps by candle power—I mean, what we shall call candle power.

The PRESIDENT: The discussion we are now engaged on is the proper classification of the lighting power of incandescent lamps. From that you can formulate your motion.

Mr. GARRATT: I wish that this committee would take this matter up and consider what is the best to do. Of course we cannot enforce anything they may recommend.

The PRESIDENT: There is one thing that we can do, and that is what this discussion is intended for. There are many gentlemen who have not the opportunity, or who have not the instruments in their stations to make the test; and they do not understand what there is to this. This is where they can come and get the information, and that is what you are giving them now at this minute, and you propose to further do it by going into a systematic investigation.

Mr. GARRATT: Yes; but it is simply to consider the best methods by which we shall talk to our customers, so that when they say, "What do you mean when you talk about a 16 c. p. lamp?" we shall be prepared to answer them. I do not think that we are prepared to answer that question now.

Mr. DECAMP: Do you mean what is the best method of determining what a 16 c. p. lamp is?

Mr. GARRATT: No; I am not going into the subject of photometry at all; that is not my intention.

Mr. DECAMP: What is the best method of determining what constitutes a 16 c. p. lamp? Is that your intention?

Mr. GARRATT: No; that is not my intention. What I want this committee to do is to bring to us a report of what, in their opinion, is the best way for us to talk to our customers with regard to the candle power of lamps.

Mr. STORKE: I second that motion.

Mr. GARRATT: If the house will permit mé I will withdraw that, as it is a little complicated, and simply move that the President be instructed to appoint a committee who shall report at the next meeting of the Convention on the proper classification of the lighting power of incandescent lamps. That will cover it best.

The PRESIDENT: It is moved and seconded that a committee be appointed by the Chair to report at the next meeting of the Convention the result of their investigations and their conclusions as to the proper classification of the lighting power of incandescent lamps.

The motion was carried and the President stated that he would name the committee later.

On motion the Association then adjourned to Wednesday, August 20th, at 10 A. M.

THIRD SESSION.

The Association met, pursuant to adjournment, Wednesday, August 20, 1890, at 10 A. M.

The PRESIDENT: The first matter to be considered this morning in the order of business is the report of the Committee on Patent Legislation, of which Mr. Arthur Steuart is chairman.

Mr. WILMERDING: There does not seem to be any member of the committee here, and I move that the committee be discharged. They have not made a report for two or three meetings, as I understand, and I think we might as well give it up. The motion was carried.

The PRESIDENT: Next is the report of the Committee on Legislation, Mr. C. H. Wilmerding, chairman.

Mr. Wilmerding then read the following report:

REPORT OF THE NATIONAL COMMITTEE ON LEGISLATION.—TWELFTH CONVENTION.

1. At the eleventh Convention this committee was instructed to "report for the action of the next Convention such changes in the constitution as will, in its opinion, best provide for the membership and representation of State associations in the National Associations. (Volume VIII., page 249.)

After this action had been taken, the Convention raised a special committee charged with the duty of making a general revision of the constitution of this Association. In view of this, this committee has considered itself discharged from further consideration of the subject.

2. By action of the eleventh Convention this committee was instructed "to co-operate with the New York State Association in securing such an amendment to the execution law of that State as to require a special apparatus to be devised for the purpose that shall generate a current of not less than 10,000 volts." (Volume VIII., page 248.)

No request has been received from the New York State Association for such co-operation, and so far as this committee is informed, no effort was made during the last session of the Legislature of that State to so amend the law. In the light of the reports made regarding the experimental execution that has since taken place in that State, it is now probably as clear to the public as it has been to his committee, that if executions are to be made by the use of electric currents, the amendment to the execution law recommended by this Association at its eleventh Convention is demanded by every humane and equitable consideration.

(a) To give practical effect to the "memorial and statement" presented to Congress in the name of this Association by its President, which was presented in the United States Senate by Senator Hale on Aug. 5 and was referred to the Committee on the Census and ordered printed, a member of this committee has prepared a bill which was introduced in the Senate of the United States Aug. 15 by Senator Hale. It was read twice and referred to the Committee on the Census.

Your committee recommend that the Association indorse this bill and urge its enactment, and that a resolution of thanks be tendered Senator Hale for his courteous and prompt actions regarding this subject.

This bill is as follows:

Fifty-first Congress, First Session, S. 4,329.—In the Senate of the United States, Aug. 15, 1890, Mr. Hale (by request) introduced the following bill, which was read twice and referred to the Committee on Census:

A BILL

to amend an act entitled "An act to provide for taking the eleventh and subsequent censuses" approved March first, eighteen hundred and eighty-nine.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

That, for the purpose of rendering the investigation of the electrical industries by the eleventh census thorough and complete in every detail, the superintendent of census, under the direction of the Secretary of the Interior, is hereby authorized and directed to make such subdivisions of the subject as may seem to him advisable, and to associate with the special agent now commissioned to investigate the manufacture of electrical apparatus and supplies and their uses, as special expert, the ablest person whose services can be secured to write the statement for each subdivision so made, subject to the supervision of said special agent; and the sum of $50,000, or so much thereof as may be necessary, is hereby appropriated, out of any money in the treasury not otherwise appropriated.

3. During the legislative session of 1889-1890, comparatively few State Legislatures were in session. During the coming legislative session 1890-1891, a large number of State Legislatures will be in session.

If legislation touching electrical interests proves as attractive to the coming Legislatures as it was to those that have recently been in session, there will exist an exciting cause sufficiently urgent to fuse all central station companies in every State into a compact organization for the protection of their mutual interests.

That ill-advised legislation will be met with in every State admits of no doubt. So long as would-be law creators think it a factor of popularity to show in their legislative records that they introduced bills or advocated measures that are intended to be, or are, in fact, antagonistic to the practical development of the electrical industries, such things will be done; or so long as persons interested in patented apparatus and systems think they can gain a commercial advantage for such interests through legislative enactments they will seek to secure such enactments regardless of their effect on electrical interests in general.

4. That those interested in the electrical industries in each State will be thoroughly organized and equipped to meet the emergencies that will be thrust upon them is very much in doubt. There is no sense of security equal to ignorance of danger. For those who are ignorant of a danger it has no existence. This we fear is the condition of most central station companies in this country, regarding impending dangers from legislation. In view of this, the greatest service that may now be performed is to so state the threatening dangers that they can no longer remain in ignorance of them. To do this, there is no need to speak of unr al things that are but creations of imagination. Sufficient material for the purpose is found in the record ot things that are.

5. To show the tendency and animus of thought of those intrusted with the responsibility of legislating for the good of the people, a critical analysis is asked for by the following brief reports on the work done by the Legislatures of a number of States during the last session.

6. *Connecticut.*

(Senate Bill No. 4.) Chapter IX.

An Act relating to attachments and judgment liens.

7. *Massachusetts.*

No better presentation can be made of the subject for the State of Massachusetts than to present in full the report of the Counsel of Massachusetts Electric Lighting Association, made at its first annual meeting under date of July 8, 1890.

8. *New Jersey.*

Feb. 12, 1890, a substitute for "Assembly 113" was introduced "by Committee on Municipal Corporations"—"An Act relating to electric telephone and telegraph wires and creating boards of electrical control in cities of the first and second class."

Feb. 14, 1890. Assembly No. 6. Introduced by Mr. Smith and referred to Committee on Corporations:

"An Act in relation to telegraph, telephones and electric companies in cities of this State."

9. *New York.*

Jan. 21, 1890. In Assembly No. 160. Introduced by Mr. Whipple, read once and referred to the Committee on Ways and Means:

"An Act to create a board of electrical commissioners and to define and regulate its powers and duties."

Feb. 20, 1890. In Assembly No. 598. Introduced by Mr. J. H. Stevens (by request), read once and referred to the Committee on Electricity, Gas and Water Supply:

"An Act authorizing water companies to manufacture and use electricity for the lighting of streets, public places and private buildings in cities, villages and towns within this State."

Feb. 21, 1890. In Assembly 629. Introduced by Mr. Whipple, read once and referred to the Committee on Electricity, Gas and Water Supply:

"An Act to protect life and prevent accidents in the use of high tension electric currents."

April 4, 1890. In Assemby 1887. Introduced by Mr. Molan, read once and referred to the Committee on Electricity, Gas and Water Supply:

"An Act to create State board of commissioners of electrical control and to define and regulate its power and duties."

April 18, 1890. In Senate No. 618. Introduced by Mr. Erwin, read twice and by unanimous consent ordered printed, and when printed committed to the Committee on General Laws:

"An Act to create a board of electrical commissioners and to define and regulate its powers and duties."

April 18, 1890. In Senate No. 634. Introduced by Mr. Erwin, read twice and by unanimous consent ordered printed, and when printed to be committed to the Committee on General Laws. Reported favorably from said committee, with amendments, and committed to the Committee of the Whole:

"An Act to create a State board of electrical control and to define and regulate its powers and duties."

In transmitting copies of these bills to the Chairman of this committee, J. W. Eaton, Jr., Att'y., of Albany, N. Y., writes as follows:

"None of these bills have become laws. I am of the opinion that an attempt will be made next year to rush through the Legislature a bill combining most of the principal features of those sent you, unless some determined opposition develops in the meantime. I believe there is also a movement in favor of adding an electrical expert to the present railroad commission, and putting the matter under their charge. There was no law of general interest affecting electrical lighting passed this session."

10. *Ohio.*

The Legislature of this State was urged to action by the following highly electrified paragraph in the Inaugural Address of Governor Campbell.—(See reports in daily press, January 13, 1890.)

"The application of electricity is rapidly opening up new fields of legislation. Unless something be done to prevent the sacrifice of life daily resulting from the effect of electrical wires the companies which put up and control them will have grown so rich and powerful that the passage and enforcement of proper laws will be difficult. Municipalities have attempted to enforce regulations for protection from such dangers, but without satisfactory results. The duty of investigating the generation and distribution of electrical currents is one which presses upon you. The investigation should be prompt and thorough, the result thereof made public, and such action taken as may, in your judgment, throttle this evil in its infancy."

The following bills were introduced into the Ohio Legislature at the last session:

"A bill concerning electric wires and circuits dangerous to life and property."

"A bill to authorize the construction of subways and underground conduits in which to place electric wire cables and other electrical conductors in cities, towns and villages of this State."

"A bill to regulate electric light companies so as to protect the public from accident and damage from the same."

"A bill relating to electrical conductors for electric lighting in cities of the first grade of the first class, and the removal of overhead wires."

11. *Virginia.*

Senate Bill No. 238. A bill for the prevention of danger from electric currents. Patron, Mr. Lovenstein. Referred to the Committee on General Laws.

12. While this report does not completely cover the ground, owing to the difficulty experienced by this committee in obtaining copies of bills and definite information regarding action taken on them, the showing is sufficient to demand attention from every one interested in the electrical industries, and will enable them to form some idea of the legislative work that is near at hand during the season of 1890-1891, when the Legislatures of some 37 States will be in session.

13. This committee desires to call attention to the fact that all legislation is directed to the regulation of the use of electrical apparatus, not to its manufacture and sale. This use includes all forms of apparatus, the telegraph and telephone, as well as the generation and transmission of electric currents for light and power. Such legislation affects primarily the interests of those who have their capital invested in plants for furnishing such service, and thus establishes a community of interest between them. The interest of manufacturing companies and supply houses in such legislation is secondary, as they are only affected through the effect on operating companies. For these reasons, and in view of the fact that legislation is confined to State Legislatures, there is a real necessity for the operating companies in every State to form themselves into associations for the development and protection of their mutual interests.

14. In analyzing the subjects of legislation, this committee would be untrue to the interests it represents should it fail to bring to notice the fact that most of the so-called antagonistic legislation is not the result of a popular demand, but issues from those interests that seek a commercial advantage by legislation that, either directly or by implication, would create conditions favorable to their particular apparatus or systems. A diminution of efforts of this kind may be reasonably expected, as the art of generating, distributing and using electric currents becomes more and more a matter of common information and electrical systems approach more nearly to the zenith of their development.

The PRESIDENT: I learned this morning of the presence here among us of the first man who ever occupied the Chair of the National Electric Light Association; and, without consulting the Convention, I shall venture to appoint two gentlemen to escort him to the platform; and I think we shall all be very glad indeed to hear a few remarks from him. The Chair will appoint Vice-President Edgar and Mr. DeCamp as such committee.

(Mr. Edgar and Mr. DeCamp escorted Mr. George S. Bowen to the platform.)

The PRESIDENT: Gentlemen, I have great pleasure in introducing to you Mr. Bowen, one of the early fathers, who has now come to take a look at his child. (Applause.)

Mr. BOWEN: Mr. President, and gentlemen of the Electric Light Association: You certainly have placed me under great obligation by the graceful compliment which you have conferred upon me in asking me to stand before you and look at the child that was born some six years ago. It is true, as the Chairman has stated, that I called a convention to order in Chicago; and I did it after some weeks of labor in sending out circulars, etc., inviting the men who were engaged in the electric lighting business to get together, to become acquainted, to rub together slightly and see what the effect might be. My own opinion was that it would be useful to us all, and to that end we created a little committee in Chicago, and I was made the Chairman of it, and I had the honor of sending out those circulars; and in response to the circulars there were about one hundred and fifty gentlemen who came from all quarters of the Union to Chicago. I mention, as I stand before you, an incident which occurred, which often has come to my mind, and it was this: Mr. Morrison, of Baltimore, said to me, on being acquainted, "What are your plans?" I said, "Well, we have no underground plans or overhead plans. My plan has been simply this: To invite the electric light men to come together, to become acquainted with each other; and after I have called the Convention to order and you are all in the room which has been provided for you my duty is done. I have no plan at all because I have the utmost confidence in the capacity of the men that have taken hold of this great business, the lighting of the world, to take care of themselves, and so I have made no plan whatever." (Applause.) And so you see, gentlemen, that it gives me the greatest pleasure; I can scarcely find words equal to the expression of the pleasure that I have experienced in all these years in seeing the growth and the activity and the real benefits that have come to the country from the organization of the electric light fraternity. I have been all over this country and a good deal over Europe during the last year, and I say to you that America to my mind seems to be ahead of Europe in the electric lighting business; and so what shall

we finally come to? I do not make any prediction but I say to you, gentlemen, you have only opened the first page. I expect to live to see the day when all these little towns all over the country shall be illuminated with electric light, and we shall not have to grope about in darkness as much as we have heretofore; because some of you gentlemen, I see it now cropping out in your brains, are going to develop a plan by which all the world may have the light at an expense so cheap and so nominal that they cannot afford to be in darkness; and so the world will be indebted to the electric light men for all of that. If it shall happen, in the course of your discussions here in regard to the action that has been taken by one of the State legislatures to make use of electricity to take human life—if that agitation shall finally develop into an expression of thought in the minds of the American people that human life is too sacred to be taken by any means whatever, I shall thank God for that; because I do not believe it is in the power of men to take human life—something you cannot restore. Certainly the man whom you would execute under these laws, and who has committed an act deserving, under the laws of the State, to be executed by electricity, or the rope or any other means, is unfit to die, and he is quite unprepared to live; and so my plan to get along with that kind of men is to educate them; give them good cold water baths, and hot too, inside and out, and wholesome food and plenty of work, but let them live long enough to be fitted and prepared either to live or die, just as God in his wisdom shall see fit. Those are my sentiments. (Applause.)

It has only fallen to the lot of a few of the great inventors of the world to see the work of their hands finally culminate in great success; and as I look over this body there comes to my mind an incident which occurred a few years ago, and I will take your time, as it will be very brief, just to recount it. I was riding down through the State of New Jersey with John I. Blair, the great railroad builder, who has spent many millions of dollars in building railroads, and passing by a little hamlet he said: "There is where Prof. Morse used to live, in that little house." "Ah, indeed!" I said. "If I had the time I would like to get out of the train and walk around there just to get a little of the aroma, the scintillations of inspiration that filled that old man's soul when he was trying to make you believe that he could send a message on a wire. What did you think of the old man," I said, "when he was trying to make you think and believe that he could send a message on a wire?" "Oh," he said, "we all thought he was a crazy old fool." Now, that was about the idea expressed in regard to him; and here is some bright young electrician who may bring to you something, and you will say, "Oh, get away. He is a crazy fool." But let me tell you, my dear friends, it is these crazy old fools that have stirred the world from its foundation to its very height; and when I read the account of Prof. Morse as he sat on the platform in the Cooper Union—I need not recount the history of his experience about going to Congress and his labors, and finally getting his telegraph wire from Baltimore to Washington, and sending that first message over that line, that wonderful message, ignoring himself completely, this crazy old fool, saying, "What hath God wrought?" Not me, but what hath God wrought? And then when he stood on the platform of Cooper Union and with that same simple messenger sent that other message flying around the world, "Glory to God in the highest and peace on earth, good will to men," what more could come to fill his soul with all that was great and noble and successful in life? There stood this crazy old fool, the admired genius of all the universe. Nothing could be more magnificent or grand in its accomplishment than that. And so I expect to see the day when these young electricians shall accomplish other things. I do not think we have got to the end by any means; and so I want to see you do what you do well. When you want a street railway and put down the electric current, put it down well. I was down at Asbury Park last night and they had a terrible storm there, and they were frightened because there was electricity on the track; and of course water is a fine conductor. I hope some day to see the wires underground, carefully put away where they will be kept dry and operative, and then you will get good results and we shall not be hearing of these terrible accidents. Either put them down underground where they are safe, or else put them up so high that they won't disturb people; and when you put them up make them secure. Whatever you do let it be done well; that is my idea, and then you will get good results. I expect to see the day when every house, every little household in the land, shall have its little storage battery and electric lights. We are going to dispense with tallow candles and even with kerosene oil. Why, just think of it; in the island of San Domingo they use kerosene oil all over the island. There was a concession brought to me a few weeks ago for lighting the island; and, gentlemen, you could scarcely get anybody in this country to go down there and put in electric lights, because they say it is too much of a venture; and still you can go there, and you can go to Hayti, and you can go all through the southern district and there is a field that is just as full of riches as any gold mine in Colorado or California; and it is all there just waiting for you to take it; and if I was a young man twenty years of age I would plant myself down there in some of those countries and I would make my fortune there. There is no mistake about it. It is there and the people are ready to pay, and they have got the money and are able to pay, and what they want to do is to utilize it.

I have taken too much of your time I think, gentlemen. I am under great obligation for your courtesy in asking me to say a word, and I can assure you that wherever I am, wherever I have been in these years, I never take up a paper that has an account of the Electric Light Association that it does not attract my attention and absorb my interest most intensely; and so I wish you the greatest, the most unbounded success, as I am sure you will have. (Applause.)

Mr. WEEKS: Mr. President, on behalf of the Executive Committee I would report to the Convention their recommendation that Mr. George S. Bowen, who has just addressed the Convention, and to whom more than to any one else, this Association owes its existence, be elected an honorary member of the Association.

The motion was duly seconded and carried.

Mr. BOWEN: Mr. President and gentlemen: You have placed me under renewed and lasting obligation. I can assure you that I appreciate this delicate and beautiful compliment to me in all its best phases, and so I only wish you the very best that God Almighty can give to you all through your lives. (Applause.)

The PRESIDENT: We will now resume the regular order of business and proceed to the consideration of the report of the National Committee on Legislation.

Dr. MASON: Mr. President, I notice that this report now under consideration and recently read by Mr. Wilmerding refers to a bill that is now in the Committee on the Census, the Committee of the Senate. I beg to offer the following preamble and resolutions:

Whereas, On the 15th of August, 1890, the Honorable Senator Eugene Hale introduced in the Senate of the United States a bill to amend an act entitled "An Act to Provide for the Taking of the Eleventh and Subsequent Censuses," approved March 1, 1889, and

Whereas, The said bill was read twice, and referred to the Committee on the Census, and

Whereas, In the opinion of the National Electric Light Association the passage of the bill is essential to render the investigation of the electric industries by the Eleventh Census thorough and complete, therefore

Resolved, That the President of this Association be requested to express this, our opinion, to the Committee on the Census and urge the committee to favorably report to the Senate the bill referred to.

Resolved, That the thanks of this Association be tendered to Senator Hale for his services in the matter of the bill above referred to.

The motion was duly seconded and carried.

The PRESIDENT: Are there any remarks on the same question? If not we will now listen to the paper on "Municipal Lighting," by M. J. Francisco, of Rutland, Vt.

Mr. FRANCISCO read the paper as follows:

MUNICIPAL LIGHTING.

Mr. President and gentlemen of the National Electric Light Association—The electric spark that Franklin gathered upon his key lay dormant for years, until from the fires of genius, guided by the finger of science, there flashed forth the electric light. This has been increased and magnified until to-day America stands as the exponent of this science, with 300,000 arc and 4,000,000 incandescent lamps flashing like meteors across the continent. Thus has science aided nature in lighting up the streets and highways of our native land, from the shores of the Atlantic, across the snowy peaks of the Rocky Mountains, to the golden shores of the Pacific.

This vast industry, requiring an army of over 300,000 men and an investment of $300,000,000, is the result of American genius and enterprise. Truly we may well congratulate ourselves that we are here to-day as the representatives of this science and industry, which is revolutionizing the world. Not only has the globe been encircled with telegraph symbols and the human voice sent flying across space for thousands of miles, but the ocean itself has been studded with electric lights, guiding the mariner across its waste of waters and flashing its brilliant hues as a welcome beacon upon the weary eyes of many a watching crew, whose vessel was sinking in mid-ocean.

This science, fraught with so much good for mankind, which has put millions of money into circulation and furnished employment to thousands of laboring men and others, is now menaced by men who, posing as economists, desire to use this power for political and other purposes, as well as for their own aggrandizement, regardless of the interest of the masses or the public welfare. The plain English of this movement is municipal control of electric lighting plants.

Who are the great apostles of municipal ownership of electric lighting plants, claiming that municipalities can furnish lights cheaper than private corporations? Mostly visionary, theoretical dreamers. Not one has had a single day's practical experience in the electric lighting business. For example, we were treated to a specious article in the New York *Independent*, purporting to come from a professor of Johns Hopkins University. An examination of the article shows at once that the author has no experience or practical knowledge of the business, and proves to be simply a youth from Omaha, Neb., who has been studying there for a couple of years. He is now told to cry monopoly, and this article is the result. These are the persons who are being used by professed economists, wire-pullers and others as figure-heads; who make statements based upon a state of things that do not exist, and use such statements in contradiction of the actual experience of practical men and the best scientists of this generation, who have not only made the subject a study, but demonstrated the same by testing it every night for years.

If a municipality can sell electricity cheaper than private corporations, why should they not manage all other industries and trades of the country? All cities have large amounts of printing done; why not have the city own and run paper mills and printing offices? also street cars, and own mines and sell coal. They also use immense quantities of stone, building material, etc.; then have them run a marble quarry. The taxpayers use carriages; let the city build these also. And so on with every industry requiring the investment of private capital. If municipalities can save the taxpayer money in controlling and manipulating one industry, why not all? If they can do it cheaper, then every taxpayer would receive the same proportional benefit as is claimed for electric lights.

The great argument used in support of municipal control of lighting plants is a list of cities, with what purports to be accounts of the cost of their electric lights, where over half of the expense of the lights has been charged to other departments. Among these are Bay City, Bangor, Dunkirk, Chicago, Ypsilanti, Topeka and Lewiston.

We will examine a few of the claims made as to the cost of lights in these cities.

The City Superintendent of Bay City, Mich., reported that the cost of the electric lights was only $40 per year. The Council of Bay City appointed a special committee to investigate the expense of city lights, and they submitted a report showing that the city was running 137 lights at a cost of $59.42 each per year, not including taxes water rates, interest or depreciation. Including interest, 5 per cent. on $35,000, cost of plant, taxes and water rates, 2½ per cent., 10 per cent. depreciation, the cost was $104 per year each lamp, running only dark nights. A short time since, during a thunder shower, the city was left in darkness, because the City Superintendent was afraid of burning out an armature if he ran the lights. A gentleman passing an evening in Bay City recently inquired why they did not have street lights, and the answer was "We do have them," and sure enough, at 9 o'clock, they started the lights. Still the price charged by electric light companies for first-class service, with lights every night, even when obliged to compete with the rival forces of heaven's batteries, is compared with such service as shown in Bay City.

The city of Bangor claims that the average cost of burning a light each night is 12⅝ cents; that is $46.23 per year for each lamp. The electrician is paid $78.50 per month, or $942 per year; his assistant receives $520 per year; one lineman is employed at $624 per year, two trimmers at $1,248 for the year—making $3,334 for wages of these men, being $22.82 per lamp per year. They run all night, requiring double lamps and four carbons for each and every day, calling for 1,460 carbons per year each lamp; for these they pay $13 per thousand, and in addition pay 96 cents per thousand for freight and five cents per thousand for cartage from the freight house, making cost of carbons $14 per thousand, or $20.44 per lamp per year. Allowing $2.97 per year for oil and waste we find the amount paid by the city for wages, carbons, oil and waste was $46.23 per lamp per year. This is 12⅝ cents per lamp per night, just what is claimed as the entire cost to the city for running their lights. The plant cost $35,000, and this does not include anything for the water power nor for any portion of construction of the dam or cost of its maintenance, or for the station buildings. Interest on $35,000 at 6 per cent., $2,100; depreciation on electric apparatus, 10 per cent., $3,500; broken globes during the year, $130; wall-controller burned out, costing $160; 15 lamps broken, repairs costing about $300; damage to mast-arms, repairs costing $100; repairs at station, $500, also $730 paid for coal. Here is $7,520, which is part of the expense of the electric lights charged to some other department, while to get the true cost there must be added to this the repairs to the dam, interest on the cost of the buildings, wages of an engineer when engine is used, cost of new brushes and segments; also taxes and water rent, which the city would receive from a private corporation if running the lights, which, at the lowest estimate, would be over $1,000 per year, thus making a total cost to the city of $15,271.86 for running 146 lamps one year, being $104.50 per lamp, and that, too, with water power all the time except for about six weeks.

The favorite place quoted by advocates of municipal ownership is Dunkirk, N. Y. I herewith give the report of the water commissioners of Dunkirk. As a specimen of expert bookkeeping, and a sample of the way accounts are kept by cities, I recommend the plan to all electric light men; for, if you are endeavoring to satisfy your constituents or stockholders that electric lights can be run without money and without price, it cannot be excelled. The report reads as follows:

"PAID ON ACCOUNT OF ELECTRIC LIGHT.

For linemen's salary	$540.00
For fuel	933.24
For supplies	447.69
For labor repairing line	41.4
For repairs on engine and boiler	65.64
For repairs on machinery	99.40
For miscellaneous accounts	14.60
	$2,141.90

"The above statement shows very distinctly that the most sanguine predictions as to the cost of running the electric lights of this city have been more than realized. After a trial of one year and eight months the machinery and line are in better and more perfect condition than when first started. The cost of our electric light does not exceed 1 cent per hour for each light."

Here we have a report from the city authorities stating that the entire cost to the city of running 55 arc lights one year was $2,141.90.

You will notice one item is repairs on engine and boiler; also one item for fuel, showing that the plant was steam power, and what is far better, a style of boilers and engine that run the entire year, starting and stopping at proper times automatically, without any one to look after them except a man occasionally to make a few repairs—the coal walked into the furnace without assistance, and no one was employed in or about the station, neither did the plant cost the city anything.

Here is a sample of the reports made by politicians and those professed economists, which shows just how reliable they are. Of course, a man with practical experience and knowing that electric lights do not run without human agency, would look further before accepting such a statement, and when we examine the accounts of the water-works we find engineers and firemen paid $3,555; supplies, $449; general expenses under superintendent, $995; miscellaneous accounts, $240; superintendent's salary, $720; interest on bonds, $7,025—making $12,984 additional. Even if only one-third of this is charged to electric lights, we have $4,328 to add to the $2,141, making $6,439 for 55 lights, or $117 each year. Consistency, thou art a jewel!

Chicago, it is claimed, is the centre of the world, and the only place on this mundane sphere where mortals can be happy, and where life can be spent without thought of money or the hereafter, because their electric lights only cost $73 per year. We admit that Chicago has triumphantly secured the World's Fair, and is now transposing our national air to "Hail, Chicago! happy land!" But they have not yet seen the bills for the electric lights as furnished by the city and used on that occasion. When they do the city electrician will need to add something more to his stereotyped answers that the cost of city lights "does not include any expense, such as you mention—taxes, water rent, interest on investment, insurance, repairs, depreciation or renewal of plant in general;" neither will it be expedient to charge the wages of the electric light linemen to the fire alarm telegraph department, notwithstanding it works very nicely now, and helps wonderfully to make the cost of an arc light appear small.

Upon investigation of one of their stations of 275 to 300 light capacity, I find that the chief engineer receives $1,200; assistant, $1,030; four firemen, $2,880; six trimmers, $3,240; line tester $720; three linemen, $2,520; cost of carbons, $3,800; fuel, $12,000; interest, $14,000; depreciation, 2½ per cent., $8,750; oil, waste, repairs, globes, taxes, etc., $7,000—making $57,190 a year expense for running 300 arc lamps, being $190.63 per year per lamp, and this makes no provision for salary of electrician, superintendent, of for armatures burned out or any accidents or damages. With the linemen's wages charged to the fire alarm telegraph department we can reduce this $2,520. Now, to what department do they charge the other expenses to reduce it to $73 per year per lamp?

Ypsilanti, Mich., is the Mecca toward which all advocates of municipal ownership turn their longing eyes, and we are informed that the entire cost of a 2,000-c. p. lamp is $23.61 yer year, when the truth discloses the fact that Ypsilanti pays $72 per year, only running eighteen nights a month until midnight. Wishing to have the views of the prominent authorities of this wonderfully managed city, the following questions were propounded, and I give both the questions and answers:

Q. 1. With your experience, are you in favor of cities doing their own lighting? A. No.

Q. 2. Why? A. Political preferences and frequent changes of management are too expensive. Incompetent engineers, linemen and trimmers kept in place by a committee for political or other purposes; poor carbons, lack of attention generally, grounding of wires, breaking of globes, infringement of patents, constant repairs, etc., make this system expensive and an unknown amount till the year expires. *The wear and tear is immense*, all kinds of complaints and no responsible head is the rule. On the contract plan for light you pay for what you get only, and know what to provide for in the estimate for tax levy.

Q. 3. If your city had the work to do over again do you think they would do the same? A. No.

Q. 4. Has the municipal operation of your plant met all expectations and requirements? A. No.

Topeka is another place where electric lights furnished by the city are cheaper than sunlight, and the city jubilant over their purchase. I quote from a letter written by a prominent official of the city of Topeka, which seems to prove that their millennium has not

yet arrived. He says: "The agreement for all night lighting was $6 per light per month. We find that the cost of operating the plant of 124 lights for all night has been $11 per month. The agreement further provided that lights should be 2,000 c. p.; all tests we have made do not show them to be over 500 c. p. Our lights so far have been very unsatisfactory. My own opinion of the matter is that it would be much cheaper in the end for the city to have contracted with some of our electric light companies here to furnish the city with its lights at so much per light. We would then have known at least just what they would cost. As it is we have to take our medicine, which is liable to be a very expensive dose. It is a very expensive luxury, and there are so many expenses coming up that we cannot foresee; therefore, I say, when you take everything into consideration, interest on the investment, wear and tear on machinery, dynamos, etc. (the contractors are already building over ours; and they have not run two years yet), consider well before contracting for a plant." Here is the opinion of an honest official who has had experience with a city owning a plant.

Lewiston, Maine, is another brilliant example of municipal ownership. They have a plant of 100 arc lights, which cost the city $15,000. They burn, on an average, 74 nights per month on moonlight schedule, and the Mayor says the actual running expenses are $4,200 per year. Add interest on cost of plant, depreciation 5 per cent., taxes, rent of water power which the city would have received from a private company, therefore it is costing the city for 100 arc lights, using water power, $7,200, or $72 per lamp per year, while the local electric light company offered to furnish the same lights for $5,760, being $1,440 less than it costs the city to run their own lights; and still it has been advertised broadcast that the cost of arc lights in Lewiston was only 14 cents per night.

I have secured reports from fifty municipal plants, embracing nearly all of the cities and towns of the United States owning plants, and find that the cost of these has been $1,511,225; that they are using 3,725 lamps; 12 places running all night and 38 until midnight or on the moonlight schedule; that the average price paid for coal is $2.34 per ton; that the actual running expenses have been $251,194; that the interest on the cost of these plants is $90,691; depreciation at five per cent., $75,576; cost of replacing armatures actually burned out, $12,000; taxes city would have received from private corporations if they had furnished the lights, $15,715—making the total expense to these 50 cities of burning 3,725 lamps (two-thirds of them only until midnight) for one year, $444,486, or an average cost of $119.24 per lamp per year. In the figures going to make up the cost of plants and the running expenses I have taken the statements and amounts as given by the city officials, but when we are told that the total amount paid for a complete plant of 68 arc lamps, with engines, boilers, dynamos, etc., was only $1,300, and informed that the total running expenses of a plant that cost $12,000 are only $1,100, and in the same communication the statement is made that they pay their engineer and linemen $125 per month, making an annual bill for these men's wages of $1,500, we naturally long for the secret which enables them to settle this amount and pay for repairs, oil, coal and other expenses with an expenditure of only $1,100.

I have statistics from 365 electric light companies furnishing 35,100 arc lamps for street lighting, three-fifths burning their lights all night and two-fifths burning until midnight or on the moonlight schedule. The average cost of coal is $2.75 per ton. The average price charged per lamp for street lights is $118 per year. This is the price when furnished by electric light companies, who have assumed all the risks and liabilities incurred in the business, and who must furnish first-class lights. This is the cost with lights burning every night without a break, as the contract calls for, and necessitating a rebate if lights are out, which would reduce the price paid by the city.

Only one-third of the cities owning plants run them all night, while of street lights furnished by private companies three-fifths burn all night. Lamps all night and every night would burn 4,000 hours per lamp, while the moonlight schedule would only require about 2,100 hours per lamp. The cost to companies, of course, is much more for all night lights than it is until midnight, and had lights run by municipal plants been burned the same length of time as lamps furnished by private corporations the average cost would have been still more, as lights must have burned about twice as many hours.

It will be noticed that the average cost of coal used by municipal plants was $2.34 per ton, owing to the fact that the majority were located near the mines or places where the coal was cheap, and the average as shown for electric light companies is $2.76 per ton, owing to the fact that the coal was transported long distances, at high rates of freight. Even with this factor against them, it shows conclusively that private corporations are furnishing cities with lights for less money than they can themselves produce them while owning the plant. This, too, with the expense of operating city plants figured as given by the various cities, which their own report shows is incorrect, and less than actually paid.

It is well known that if a private corporation is furnishing municipal lights, when they are out for a short time or are not up to standard, a rebate has to be made, amounting in the aggregate to many thousands of dollars; but you will never see this item deducted when advocates of municipal control are quoting the cost of lights. Neither do they allow the fact of the city's liability for damages and accidents to be developed. If the municipality own the plant they assume these chances, and here is a feature of responsibility which in most States rests upon the individual as well as the city. The property of any citizen can be held for an execution against the town for injuries caused by a municipal plant, no matter if it amounts to thousands of dollars, and thus he might be deprived of his most valuable personal rights and liberties. If electric light companies furnish the lights they must meet such claims and protect the city from loss, and the court records show that electric light companies have paid heavy damages on this account.

In the reports received from city officials regarding the cost and operation of their lights, one says: 'No expenses charged to lighting account." Again: "Lights are not started for an hour after dark." Many say: "Whenever a thunderstorm approaches lights are shut down and city left in darkness." Another says: "Have not had lights for past two weeks, owing to some trouble at station;" while many report wages of employés charged to water department, and others that no report of lighting expenses is kept. Here we have the basis upon which reports are made that the cost to cities owning plants is much less so than it is when private corporations furnish them, simply deceiving the tax-payers by charging part of the cost to other departments, while raising a hue-and-cry about the extortion of electric light companies.

No sane or fair-minded man will, with the corruption and fraud practiced by politicians at the present day, attempt to prove that it is for the best interest of the tax-payer to place faith in the honest or conservative management of any enterprise which can be manipulated in the political arena for the advancement of men in power. The histories of New York, Philadelphia and many other cities are samples of such methods and their purifying effects upon politics. Hypothesis and theory may do on paper, but actual results obtained by practical application and experience are the only reliable data upon which to base any statement relating to the cost of street lighting. In every case these have shown, where all the facts are given, that it has been for the best interest of the citizens and taxpayers to contract with an electric light company for lighting the streets of any city.

Many cities have found by actual experience, after spending a large amount of money, that this is a fact. The city of Greenville, S. C., has sold out its municipal electric lighting station, the purchasers agreeing to relieve the city of all pending liabilities in connection with the light plant. The city has agreed to pay $109 per year per lamp for not less than 40; the agreement to run for 15 years. Negotiations are pending in several other cities for a sale of their plants to the local or private electric lighting company, as they have found it was impossible to produce the light, when managed by politicians with no interest in the business, as cheaply as could be done by a private corporation whose managers were financially interested in its success.

There is another feature of this business that it is well to consider. Under the authority and sanction of the legislatures of the States, private capital amounting to millions of dollars has been invested in the enterprise of electric lighting. The benefit that municipalities have received from this capital is enormous, and it is a question whether the private capital thus locally invested under the sanction of the State can be jeopardized and endangered by the action of municipalities, who are subject to and under the control of the State. In England this matter is fully settled, and no municipality can operate its own plant, if by so doing it will interfere with any local or private company authorized by Parliament.

Judging the future by the past, with the mighty strides that have been made in electrical inventions, two years from now the entire apparatus at present owned by municipalities may be consigned to the scrap pile, and necessitate a new outfit costing thousands of dollars. What is to be done in this case? Levy another tax or issue more bonds, and thus load the city with more debts? Electric light companies have already had this experience, and I can cite a case where the company paid $4,500 for their dynamos, and, after a little over two years, could only realize $300 from those same machines. Why is this? Simply that improved plans and apparatus have been discovered which reduces the cost of producing electricity, and unless companies can control these new patents they will be stranded in the race of invention.

Consider, then, for one moment the effect upon the business world if to-day it were possible to blot out electricity and electric lights, with all their conveniences, comforts and luxuries; to stop the progress and development of this wonderful science, and shroud America in a gloom that could only be expressed by Byron when he "had a dream which was not all a dream," and

> "The bright sun was extinguished,
> And morn came and went—and came—and brought no day,
> And all hearts were chilled into a selfish prayer for light.
> The rivers, lakes and ocean all stood still,
> And the clouds perished. Darkness had no need
> Of aid from them—she was the Universe."

The PRESIDENT: The Chair will announce the appointment of the committee of three on the proper classification of the lighting power of incandescent lamps: A. V. Garratt, Louis Bell, P. H. Alexander.

The paper which has just been read is now open for discussion. Are there any remarks on the paper just presented by Mr. Francisco.

Mr. WILMERDING: I move a vote of thanks to Mr. Francisco for the able way in which he has set forth this matter. I hope that the paper will have a circulation all over the country, and do some good: and I think that the Association ought to thank Mr. Francisco for the labor and care that he has taken in preparing this valuable paper.

Mr. DECAMP: I think that the most lasting compliment which can be paid to the author of that paper will be for this Association to authorize its printing for general distribution among the members, so that they may all have an opportunity of making direct use of it. I do not think that a paper of that kind should pass without very general remark by this Convention upon it. Personally I do not feel competent to do it because I have not been touched as yet in that direction. I would probably be a little more lively at the present time if I had been. But, in listening to the paper these things struck me. It is known to every man on the floor of this Convention who is engaged in the business of electric lighting that municipal ownership of electric light plants has its origin among a few politicians who wish to add another plum to the public pudding that they may pluck it. There is no question about that. There is no sentiment in it; it is a simple matter of fact. The public, who have to pay for this, know nothing else excepting perhaps the two or three points which the public know fully as well as their servants in these matters; and one of them is the fact that there are certain things in connection with municipal management that are always notably extravagant. It is not the fact that a municipal government has no right to engage in anything in which it is the sole consumer. I do not admit that at all. I admit it to be for the general good for them to keep their hands out of everything and let whatever profit there may be in it go to the tax-paying citizens. But that is my view, and that is perhaps a radical view. If you take it on the ground that the public should do their own printing—there is a measure of truth in that, and there is a measure of justice in that which does not apply to anything like the municipal ownership of an electric light plant or a gas plant, from the fact that their ownership of that affects nothing except their own trade. Printers do business just the same as other concerns do business; they are not obliged to go to the State Legislature and get a charter, or to pay municipal taxation on their charter rights. For that reason they are excepted from the conditions which apply to electric light companies. But there is one point that might well go forth in some shape, and which would wake the people up a little who have the final decision of these matters. I suppose that it is pretty nearly a correct statement that from 50 to 60 per cent. of the total cost of producing electric light is in the labor account alone. It is one of the most difficult problems that electric light companies have to contend with. It is something that is the hardest to control. Now, if there is anything under God's Heaven in which there is extravagance practiced by municipal governments, it is in the matter of labor. For a municipal government, it invariably takes two men to do one man's work. They are, as a rule, extraordinarily extravagant in the matter of labor, to say nothing of the other elements of political patronage which enter into it. Some time ago a man left our employ who was getting what, we thought, good wages, two dollars per day. He was not a skilled laborer in the true sense of that term. He took a position under the city government at two dollars per day, in which he worked eight hours per day, whereas he had been working 12 hours; and he took a position in which two men had been doing the whole duty, yet he made the fourth man who went in there. Figuring this up it means about 200 per cent. increase on the cost of labor for that one particular thing. The extravagance of municipal governments in the matter of labor is a fact pretty generally appreciated. But I would like to see this report printed, and I would like to have copies for free distribution among the members. I will pay for it if it cannot be done in any other way.

Judge ARMSTRONG: I feel myself very much obliged to Mr. Francisco for this paper. The instances he cites were used as against our company about a month ago, when we made our annual bid for lighting our city. It so happened that our general manager had the answer ready to most of these criticisms and yet a new member of the city council, flushed with his victory at the polls, and believing that the eyes of the whole community were upon him, and that upon his shoulders rested the protection of the taxpayers against a grasping monopoly that had the lighting of the streets, went into the City Council and claimed that our bid for lighting the city was entirely too high, and that Bay City, Bangor, Dunkirk and all the rest were having the lighting done at so much less. The answer to all those criticisms was made in such a manner that nothing further could be said. But how much better, Mr. President, we could have answered it had we had this paper to hand to every member of the City Council, so that we could say to them, there is the author's name; there are the facts; now say what you please concerning it. There was one thing further, and possibly an opportunity will come to speak of that later, which we cannot so well answer. There were parties who desired to sell one or two dynamos to other companies, that inspired other bids. We may be able to speak of that after a while under another subject. But, Mr. President, let it be clearly understood here—and I think it is clearly understood—that never does a municipality desire to engage in any business. I wish that Mr. DeCamp had illustrated how the citizens of Philadelphia felt about their ownership of the gas plant that they have been blessed with for a good many years. I wish that he had given that here. Now, let it be understood that at no time, and under no circumstances does a municipality desire to engage in business. Why then does it own water-works? Why does it own gas works? Why does it own electric light plants? Usually because it cannot find citizens who are willing for the public benefit to put their own money into the enterprises, because the enterprise at the time it starts is too large to enlist the citizens or induce them to go into it. Gentlemen, when you start an electric light plant in your city you do it with the distinct understanding that for a long time you are to get no returns; you do it looking after the future. If you start a gas plant, if you start a railroad, if you start a water plant, if you do anything of that kind to supply the public, you do it, of course, expecting an ultimate return to yourself and to your stockholders; you do it looking to the future. Sometimes cities are enterprising enough to look out for the future themselves, without asking the citizens to do it, and without expecting the citizens to do it. Now, I venture the assertion that no economist who has studied the question, no economist who has gone over the whole ground, will ever advocate taking from a private enterprise anything like electric lighting, or like water-works, or like a gas plant, or like printing, or like the railroads, or any other such enterprise, and putting it under municipal control. I will ask the managers of electric light companies here, if they were managing for the public, if they had a public treasury to call on for anything and everything they wanted, whether they would be (and I think they are perfectly honest and upright men) as careful of their expenditures as they are compelled to be to-day. If my purse were unlimited I would have the very best that there was. I would indulge in the most costly experiments, for I would have wherewith to pay for them. And so would you do the same thing. It is a natural thing, and a proper thing, I take it. Therefore, it is as we say that the cost of lighting must be far greater to a municipality, by necessity, than to a private enterprise. I want again to thank the author of this paper. I want to endorse very heartily Mr. DeCamp's suggestion that we have this printed by the Association for distribution throughout all of the cities where electric light is furnished by private corporations, and the facts contained in this paper will do much toward making a proper feeling, a kindly feeling from taxpayers and citizens toward our companies; and when we shall have accomplished that I think we shall have done a great good in the way of making popular our work and in the way of enlightening the people on just exactly the grounds we have to work and where we expect to get our returns and what we furnish for it and how we furnish it.

Mr. BARRETT: I am unfortunate in having such a cold that I cannot make any extended remarks on this subject, but I notice in looking over the account here that I am asked, or the city electrician is asked, some very pertinent questions. I do not advocate the absorption of a commercial business by any municipality. That never does. The city of Chicago, through its electrician, has simply performed the orders which he received. This statement strikes me as rather a singular thing. I find here that the cost of municipal lighting is set forth very clearly, very extensively and very expensively; but I have never, in all my experience with this Association seen a tabulated statement of what it costs to light a commercial plant, per light—never in all my life. Now, this is what strikes me as being rather singular. Why cannot a city light its streets as cheaply as a commercial company can? Is the market not open to the city to purchase its material? Can't it hire its laborers as cheaply as anybody else? Has it not an officer, and is he not compelled to report expenditures just as clearly and distinctly as does the head of any private concern? Why should it cost the city more than it does anybody else? This is rather different at home. I have charge of the municipal service of the police, fire, Board of Health, and the city lighting. I place my hand usually in either one of these departments, and therefore I get economy as to materials. I do not claim that I can light a lamp any cheaper than anybody else. I do not claim that it costs me any more than it does anybody else to light that lamp, except in labor alone. We do have to pay more for labor than anybody else. If I could get this lighting from corporations anywhere here, for what it costs us to maintain our own lights, I assure you, gentlemen, that I would recommend it. You will excuse me for not saying more, because I am not able to talk; but if you want to ask me any ques-

tions I will try to answer them, although I do not want you to ask me to make any speech.

Mr. GARRATT: It seems to me that the simplest reply which can be made to the question why, or why shall not a city do its own lighting, will be found right in the words of President Cleveland on the Tariff question, when he said, "In this matter we are dealing with a condition of things and not with a theory." If we were dealing with a theory there is absolutely no reason why a municipality cannot do any business that any citizens are engaged in more profitably than the individual citizens can do it themselves. We are dealing with a condition of things which, in the United States under our form of government is this: that the government shall not in any way interfere with the rights and privileges, the pursuit of happiness and the success of its citizens; that the citizens themselves shall do the industries of the country; that the government shall be as small and as insignificant as is possible to hold people together in a civilized community. That is the simple question. Theoretically speaking, I see no reason why a municipality cannot bake the bread for the people, or why it cannot butcher the beeves. There is no reason why, except that in the condition of things under which we are living it is entirely unfeasible.

Mr. DECAMP: I think Mr. Barrett put the true question when he said "Why can't it be done?" Well, there ought not to be anybody more competent to answer that question than Professor Barrett himself, because he is right in the business, but he don't do it. Now in reply to the other point, in which he says that no commercial plant has come forth to say what their lights have cost them, there is a plain answer to that That has not yet become necessary, and it is not customary, except by the lowest bidder. Now the figures which Professor Barrett has named and set forth and published broadcast over the world—or which have generally gone forth; I don't say that he published them—have been so much lower than any commercial company has ever produced their lights under anything like similar circumstances, that that thing is not at all necessary; there is no use of doing it. A commercial company who have stockholders to serve and who are under certain confidential obligations, which are generally recognized, are not in the habit of publishing that sort of statement. So that I presume when the commercial lighting comes down to a point where they can produce the lights at a less cost than the municipal plants are now costing, we shall hear just what they cost; and they can very well afford to wait until that time.

Mr. DUNCAN: Mr. President, our friend, Judge Armstrong, of New Jersey, has hit the case fairly well when he stated the case of the representative of the municipal body who lacked information. I am not here to defend municipal bodies. I know something about the manner in which municipalities are conducted. While my friend DeCamp thinks that every man who has ever had any connection with a municipal body must naturally become dishonest, I differ with him. (Laughter.) I believe that the same percentage of honesty will prevail in municipalities as in the Electric Light Association. But, sir, the information that the gentleman from New Jersey had to put before his men was meagre. What we want to do at the present time is to place the statistical information which has been prepared by Mr. Francisco with a great deal of labor and care in such shape that members of this Association can use it when this question arises in their own cities or towns. Now I do not blame that man in the New Jersey town as much as I do the Judge. I think it was his duty, as he was the most interested party of the two, to obtain this information at any cost. We are to-day all on the same platform and we are going to commence and get this information where it will do some good. I hope the resolution will pass.

Mr. BOWEN: Mr. Chairman and gentlemen—I have listened to the discussion with a great deal of interest, having had something to do with city lighting myself, and rise especially for the purpose of approving and commending the suggestion of our friend from Philadelphia, Mr. DeCamp, who advises the publication of this paper for general free distribution. I know of nothing that will dispel so much darkness as light; and this paper throws a good deal of light upon this subject; and I should recommend and should be quite willing to pay my proportion for the publication of ten or twenty thousand copies of that paper, that it might be distributed very generally all over the country; and I am quite sure that if that paper were sent to a great many towns in the United States, to Aldermen perhaps, or the Mayor, or some of the principal persons there, that it would create a disposition to look into the subject of electric lighting and see if they could not improve and benefit the town by a better system of illumination; and I am quite sure that that would be one of the very best advertising documents that electric light men could send out; it would bring them a great many orders.

While I have the floor I will take just a moment to say that, although I am out of the electric lighting field now, I extend my cordial sympathy to all of the gentlemen who are in the electric lighting business who are furnishing cities with light and have to deal with city councils. Criticisms are frequently made. I have been the subject myself of newspaper criticism to such an extent and to such a degree that I have been almost immortalized in my own locality as the great coupon clipper of an electric light company that made its lights without any cost. In fact, I have been charged with producing light without the consumption of any coal. It is most surprising, all these things that you hear talked about. Here is something which throws light on these subjects. I always contended that if you want to make a good light you must first produce power; and you cannot produce power unless you consume coal, and that costs money in our country, and I think it does down here. So the information which is conveyed in this paper will be very useful, and will produce a great deal of excellent thought, and you will get good results from it. In this statement regarding the lighting of the city of Dunkirk, it is said that after using their machinery for a year and eight months their lines are in a better and more perfect condition than when they first started. That differs from what my experience was, because about the first of the year after I put in my plant I had to build it all over again, and I have heard of others that had to do the same thing; and that is why I suggest to you that whenever you do a thing do it well. On that point I want to say one thing. Professor Barrett enjoys the confidence of every man in Chicago, whether he is a democrat or a republican. They all refer to him as an absolute authority, and he has absolute authority to carry on the electric light business, and his bills are paid. There is the great advantage that he possesses. I happen to know of a city where a while ago they wanted a few brushes, and they sent the city clerk to the nearest seaport town, and that happened to be Chicago, to buy a couple of pair of brushes. That cost the city some fares, etc., and gave the man a chance to go to Chicago. There cannot be a thing done unless a committee passes upon it. If a man wants to sell a few carbons they call the committee together, and all of you know, who have had anything to do with selling carbons, what you have to do when you meet a committee. (Laughter.) All these things can be avoided by having absolute authority, as Mr. Barrett has. I congratulate him and I congratulate the city, because he is a man of great capacity as an electrician, and is an honest and square man. That is the kind of man we want to run our electric light. (Applause.)

The PRESIDENT: The question is upon the resolution. Shall we print a certain number of copies to be left with the Executive Commitee for general distribution.

The motion was carried.

The PRESIDENT: Next in order is the report of the Committee on Resolutions, A. F. Mason, Chairman.

Dr. MASON: To your Committee on Resolutions have been referred only two. I will read the first:

"That a committee of five be appointed, of which number the President of the Association shall be ex-officio one, the other four members to be appointed by the President, who shall offer their services to the authorities of the Columbian Exposition with a view to securing suitable facilities for the proper exhibition of electrical manufactures and appliances, and in general to work for the advancement of electrical interests, and to offer the authorities of the Columbian Exposition the co-operation of the National Electric Light Association to aid in making the Exposition a success."

Dr. MASON: The second resolution which came to our hands is the following:

"That the committee request the selection by the authorities of the Columbian Exposition of Mr. John P. Barrett to have practical charge and control of the electrical department of the World's Columbian Exposition."

Your committee recognizing the fact that while before the present gathering probably the larger part of the members of this Association had personally recommended the appointment of Mr. John P. Barrett by the authorities of the Columbian Exposition to the charge of the electrical department of the World's Columbian Exposition, yet that, on the floor of the Convention members have expressed the opinion that it is outside the province of this Association to offer such recommendation; your committee, therefore, return this resolution to the Association, suggesting that it act upon the same without suggestion from its committee.

Mr. BROWN: I move that the report of the committee as to the first resolution be adopted.

The motion was carried.

The PRESIDENT: The second is a resolution that the committee request the selection by the authorities of the Columbian Exposition of Mr. John P. Barrett to have practical charge and control of the electrical department of the World's Columbian Exposition. The committee returned it without recommendation.

Mr. ALEXANDER: I move that the resolution be laid on the table.

Mr. ARMSTRONG: I second the motion.

Dr. MASON: It so happens that each member of your committee has personally in the past, before coming here, signed a recommendation. We think we may go further than we did in our report. We think a majority, if not nearly all of the members of this Convention, have done the same thing; and we did not think it was competent for us as a committee to pronounce upon the — well, the scope of this Association. I merely wanted to make that suggestion.

Mr. ALEXANDER: Mr. President, may I be allowed to make a remark? I say this, that a great many have signed it, and some I find have not, and they did not want to be committed, in common with all, to any individual.

The PRESIDENT: The motion is that the resolution lie on the table.

Mr. DUNCAN: May I ask for information before that vote is taken?

The PRESIDENT: Yes.

Mr. DUNCAN: The question was this: The Chairman of the committee, in making the explanation, said that he thought it was outside of the province of this Association to commit itself to anything of that kind.

Mr MASON: No; I said that the committee considered it outside of its province to determine for the Association whether or not it was.

Mr. DUNCAN: Now, this question is in this shape, so far as I understand it: it is to lay it upon the table. It practically does not decide that question, but simply decides the point that the committee will practically indorse the subject matter laid on the table. Now, the question of information that I ask is this: Have we in our record any precedent at present for anything of this kind?

The PRESIDENT: Not so far as I have any knowledge.

Mr. DUNCAN: I understood we had taken practically the same action in regard to the census question; that through our Executive Committee we had practically taken this same course. If I am wrongly informed, then there is no precedent. If that is correct we have practically entered upon the same line of proceedings. If that is correct, I shall vote against laying it on the table; if it is not correct I shall vote to lay it on the table.

The PRESIDENT: The question is not debatable—to lay upon the table. We shall have to vote upon it.

Mr. ALEXANDER: I rise to a point of order.

The PRESIDENT: The question is not debatable. The Chair cannot listen to any more remarks in the line of information. What is your pleasure? Shall this resolution lie upon the table?

A vote was then taken upon the motion.

The PRESIDENT: The Chair is unable to decide whether the motion was carried or not.

Mr. ALEXANDER: I move that the roll of active members be called on this question.

The PRESIDENT: I think 10 members have the right to demand it.

After some further discussion the roll call was completed.

The PRESIDENT: The Secretary will please announce the vote.

Secretary FOOTE: The vote as corrected, eliminating the two votes that were challenged, stands 26 Yes, and 17 No.

The PRESIDENT: The motion to lay on the table has prevailed.

On the motion of Mr. DeCamp, properly seconded, the Convention adjourned until 4 P. M.

FOURTH SESSION.

The Convention was called to order at 4:30 P. M.

The PRESIDENT: The first business in order will be a paper or address by A. J. DeCamp of Philadelphia, on care and labor in electric light stations and its value.

Mr. DECAMP: Mr. President, I did not prepare any paper on this subject. It is pretty hard to do. This Association would get very tired of a subject treated in that way. In the first place I would amend that title by calling that the value of details which cover—

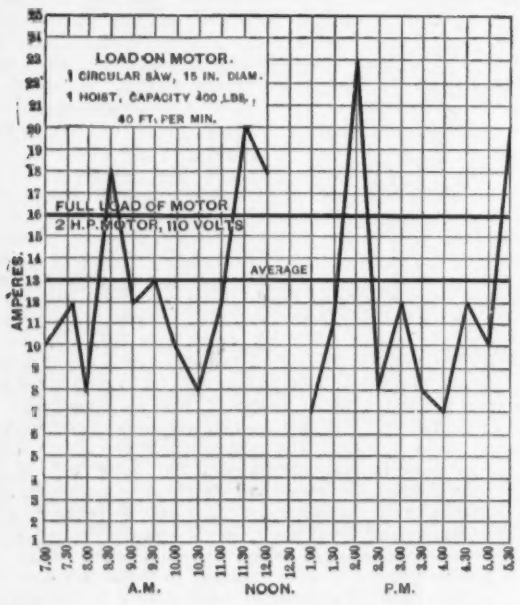
The PRESIDENT: Value of details in the care and labor of electric light stations.

Mr. DECAMP: Yes value of details in electric light stations. It certainly is a fact, apparent to any one who has had the handling of electric light stations, that it is essentially a business of detail. The larger items about the business are very easily handled. They will take care of themselves if they are put in the right direction; but there is an indefinite number of small things which very materially affect the successful operation of an electric light station. As an illustration of what I mean by that term, I will say, that after considerable reflection and dividing the items worthy of care and attention in the management of the business under fifty heads, all of which have to be kept track of, all of which are a positive and a direct item of expense or income, I find in looking over it for this purpose, one, two, three, four and five items which I have had to class as miscellaneous expenses, by which I mean are grouped all those items of expenses which have a bearing on the business in general not chargeable to any one of the particular heads under which I have seen fit to group the business. Now in going further, in looking at the records, I find that the amount involved in miscellaneous items for the last year in one company was about $15,000; going further, in looking into the records to see what they consist of, the space occupied on the book of the company to cover these small items was very nearly twice as much, in other words it covered twice as many pages as the whole of the other part of the business. The items there reached from one penny up. There is no doubt but that detail may be carried to such an extent that it becomes burdensome. It may become unprofitable on some particular item, but we can only treat this matter as a whole. Now the effect of that, other than the actual amount of money, is that by the insistance upon detail and consequently a check upon waste, inasmuch as those details develop on the part of employés of the company and those who have the use of your property—you either use it for good or for ill—that there is a supervision over that and consequently a greater care on their part. I will have to illustrate somewhat, and I will say that in one item of carbons alone, where they were treated, you might say, by the inch, the reduction in the expense of the carbon caused after a system was adopted by which they were accounted for on the basis of the inches, was a saving of nearly fifty per cent. in that item alone, and on following the adoption of that plan. That is proved to be correct because it has been in practice for the last five years fully. Another important thing is the matter of discipline, because it is utterly impossible to get the detail part of your business thoroughly carried out unless you have a thorough discipline about your station. The most important item in the whole operation of an electric light station in point of dollars and cents is that of labor, and I do not see but what it will always be the case. It is a most unsatisfactory thing to deal with. I remember there was a time when we thought that 60 lamps on an ordinary circuit was a day's work for a man. Now they trim a hundred lamps more easily than they used to trim 60, and my own judgment is that in the course of time we will work up so that 150 will be no harder than 100. But it takes patience and great care to bring that about without a temporary effect upon your business and the perfection of your service. A custom of dealing with labor, I think, which requires the counting of every minute of time for which a man is employed has a very beneficial effect. I think that alone can be credited with a reduction in the pay roll in the course of three months in which it is getting into shape—a reduction of the pay roll account of some twenty-five per cent. Now it takes a little time to do that, and you can count that time lost, and when you get ten or fifteen or twenty men they are scattered all over a great city in groups of two or three or a single man. He gets outside of your control and you have no means of checking him. He may do a half day's work in a day, or he may do a quarter, if the account is settled at the end of the week or at pay day. A custom adopted for the men which is simply for ten hours a day of having a slip furnished to him by which he accounts for every hour of that service gives the man who has charge of him an opportunity of judging for himself whether that man has employed his time properly during that ten hours. The adoption and the rigid enforcement of the thing in our station did not grow out of any idea of accomplishing the object which it has accomplished. In the early history of the business—I think I have stated so here before, but I will repeat it for this purpose—it was the custom of my company to do a great deal of work without charge. That was done for policy's sake. The question arose as to the enormous expense of our labor and the number of employés we had on our pay roll, what they did and how they could employ their time, and as the balance was on the wrong side of the sheet, among other things, it received very careful attention. The number of men apparently required for the operation of the station was very far in excess of what anybody ever represented it to be or supposed it to be. In looking into it we found that there were two or three men working here, and two or three there, and three or four somewhere else. What were they doing? Well, they were making changes; they were shifting the position of lamps; they were doing this, that and the other thing. Well, we were going to be through with that—that would all be done with and we could let these men go, we thought. But the fact is they never did go; they hung right straight on all the time. That work was all being done without any charge, and the shortest way of getting at it was to say: Here now, that is all right; we must attend to the demands of our customers. If they have anything that they want done it must be done and there is nobody who is better qualified to do it than we are. We do not want to leave it to somebody else to do. So we closed that month and started in the next on the basis of charging for that work. The basis of that charge was mainly for the labor. The labor was charged at thirty cents an hour and all waste materials—that was absolutely wasted. We did not charge for anything that would be incorporated into our own property there at all, but wires and screws and things of that kind that would probably never be of any use except for that particular purpose. At that time I think we were running about 350 lights, and when at the end of the month we charged that up and footed it up to see what it amounted to, it amounted to eight hundred and some odd dollars. We tried to collect it, but I presume we did not collect more than $200 out of the $800. People demurred and would not pay it. But it brought the thing to an understanding. Now, no work is done after the first installation—no work will be done—unless it is paid for by our customer, and we get an order from our customers in which they order the work to be done and to charge to their account. That brought the next month's charges down, and all we

had occasion to charge them was something less than $200. There could be no better proof in the world than that very fact that as long as people did not have to pay for a thing they were free to indulge their fancies. We would move a lamp here one week and move it back the next, and move it to one side the next—mere freaks of fancy; but as soon as it cost a penny it stopped—it was not worth anything. Now we go on and follow that and our charges are very small.

Another point. We send a man out to do a job and he comes in and charges three, four, five, six, ten hours' time. The man for whom that work is done cannot account for more than an hour or two. Then comes your discussion on the payment of that account, and it is a great trouble. We know nothing. We charge a man time from the time he leaves the station till he gets back and reports to us, and whether he has put in that amount of time, less the time of coming and going, of course we have no means of knowing—at least we did not—we get nearer to it now. Consequently comes this—a man goes in and goes on duty at seven o'clock, and is employed for 10 hours. He has got to account for those 10 hours through the day, where he has been. Now your superintendent can follow, and he can come to some conclusion. If the man says I was there two hours, and in the superintendent's judgment it is a one hour's job, you put a check on that man; but under the old system he could not tell where that man went to, he might have been on two or three other jobs. That is one of the things that takes a great deal of time, and I have noticed that our charges for that sort of work are very much more equitable, according to the judgment of our customers, than they have been heretofore, and, moreover, we find that the men do a great deal more work. Hence the conclusion that any one would naturally come to is that under a loose system a man has spent a good deal of time in doing nothing, and at our expense, or the expense of the people whom we propose to charge for it.

Another question which I think can be very profitably discussed, is that which relates to small matters of income on your revenue account. I would be very glad to hear such a discussion, and I will simply throw out a few suggestions so that some one, who has perhaps taken the matter up, and has had more experience, can talk upon it. The electric lighting business is not in such condition that you can take the ordinary stand and say to the public, "You will take just what we can give you, and just as we want to give it to you, or nothing." We make our contracts as specific as we can; but we have not got a contract under which we have not given more service than we agreed to give in that contract. The service rendered is never below the standard. We have lights running on the twelve o'clock service plan; and our contracts for that service cover seven hours of maximum burning. That would mean strictly that at no time was the service rendered by those lights to exceed seven hours, which, in the winter months, is from five to twelve. But that does not do, because 5 o'clock is not early enough in three or four months of the year, when the lamps are sometimes lighted as early as 3 o'clock. It means more than seven hours in point of fact. It means rather an average of seven hours than it does a maximum of seven hours. In any city where the restrictions on the running of wires makes it necessary, or sometimes it is demanded, that you put half-night lights on all night circuits with the object and purpose of switching them off, individually perhaps, at 12 o'clock. A customer can hardly be relied upon to do that. He may do it, or he may not do

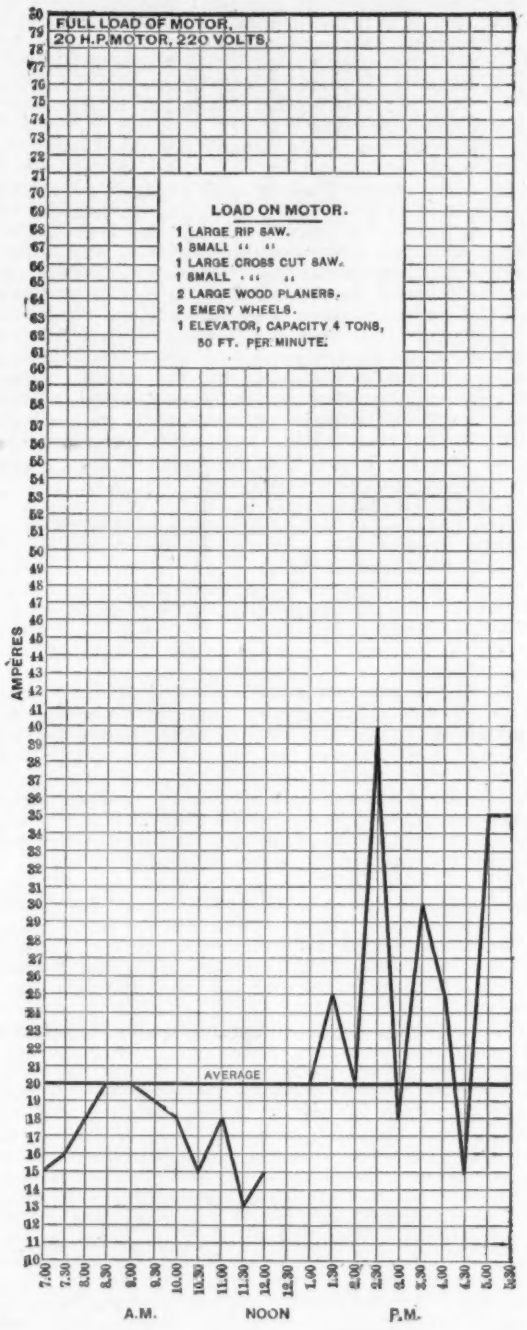


Average Load.....81 per cent. of Rated Capacity.
Maximum Load.....44 per cent. in excess of Rated Capacity.
Average Load.....51 per cent. of Maximum Load.
Shafting.....55 per cent. of Average Load.

No. 2.

electric light central station men, I never have found any one yet who seemed to have any appreciation or any interest in knowing just exactly what his product cost him on the same basis on which he sold it. To get at the cost of a light, or of any particular part of it, it is very generally figured up as a horse power. But the point that I have always contended for is this: I rent a light for a given length of time—for a year, if you choose, which is the most favorable contract that I consider that we can make, because it gives us the longest service; and in doing that, if you figure it on the basis of excepting Sundays, you rent your lamps to furnish 312 lights, which you sell at so much per light. Now, you really want to know not what the 312 lights cost you, and how much you get for them, and take the difference and let that be profit or loss just as it happens to be; but you want to know just what each one of those lights costs you, and you want to know it as a whole; you do not want to know whether it takes one horse power, or two horse power, or half a horse power; as there are a great many other things besides horse power that enter into this question.

Another thing that I find is a very common practice is to have a uniform price for a light of a certain character, whether the contract is for furnishing light for six months or for a year. The same rate for the longer and the shorter term is unjust to your long-contract customers. It is a very easy thing to rent lights during the six months of the year, commencing the 1st of September, October or November, and it is a very easy thing to keep such customers



Average Load.....25 per cent. of Rated Capacity.
Maximum Load.....50 per cent. of Rated Capacity.
Average Load.....50 per cent. of Maximum Load.
Shafting.....75 per cent. of Average Load.

No. 1.

that the company will duplicate for him any contract that it has on its books. I contend that if we could (and for one I want to try it some day) run our arc light machines from the time of starting up in the morning, continuously, as we run the incandescent machines, and make your contracts to run from time to time at certain hours of the day—if there was any possible way of doing that, and charge by the hour, or at least by a group of hours, rates in that way, you would meet a very great demand and do justice to customers and popularize the business.

I have not said much, but I would like to hear these things discussed, and I presume that every one here has had some experience in the line of what I have been saying.

Mr. C. R. Price: Before the matter is dropped I would like to ask Mr. DeCamp a question. I did not get his idea with regard to the charges for electric light service under those circumstances—whether he would change the rate for small customers, or whether he would fix one rate right straight through the year. I did not get his idea as to that.

Mr. DeCamp: I have only referred to the graduation or scheduling of prices in accordance with the services required.

Mr. Price: You would make a charge at so much per hour?

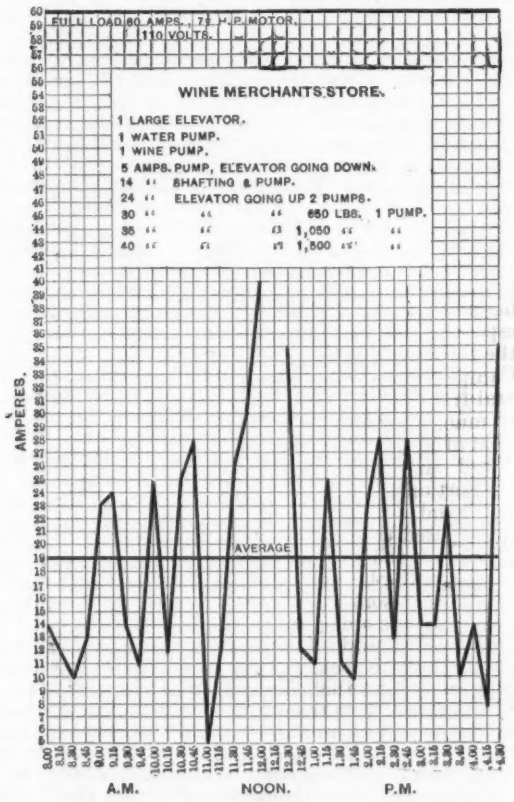
Mr. DeCamp: No. What I say that we are doing now is that if we make a contract for a year for a lamp which renders us an income for 312 nights in the year, we fix a rate for that. We consider it, on account of its giving us the most service for the period covered, the best form of contract that we can have. Now, if a party comes in and wants precisely the same lamp to burn the same number of hours per day, but says, "I will contract to give you service for that lamp only six months of the year," then I contend that that man should be charged a very much higher price per diem than the man who takes it and gives you a guarantee of 312 nights of use.

The President: The next paper is on "The Proper Basis for Determining Electric Motor Rates," by Mr. H. L. Lufkin, of New York. The paper will be read by Mr. Joseph Wetzler.

A PROPER BASIS FOR DETERMINING ELECTRO-MOTOR RATES.

By H. L. Lufkin.

The equitable adjustment of motor rates, or rather the rates per month, or year, for the supply of current for the operation of electric motors, has long been a matter of considerable annoyance to companies supplying electric power. It is obvious that to invariably charge the motor user an arbitrary rate per horse-power for the motor which he uses, based on its rated capacity, and regardless of the work it is doing, is not satisfactory, for the reason that the manufacturer usually prefers to buy a motor somewhat more powerful than his work really requires and thus avoid the possible damage to his motor from overload, or the strain to which any



Average Load.....32 per cent. of Rated Capacity.
Maximum Load.....67 per cent. of Rated Capacity.
Average Load.....47½ per cent. of Maximum Load.

No. 3.

VARIATIONS OF LOAD IN ELECTRIC MOTOR SERVICE, ILLUSTRATING MR. LUFKIN'S PAPER.

The only safe way to do it is to have them switched off by your own employés. In the same way with all night lights, which might be run, and sometimes are run, and continuously run for 15, 16 or 17 hours—starting a portion of the lights at three or four o'clock, and switching them all out at two or three o'clock in the morning, but letting the street lights go on a couple of hours later, and running them all that much later. Now, that is a demand that is made upon you by the users of your light, and it must be met. Those conditions must be met. You must give the people what they want, or you will finally lose your business, and you will have to be getting new business all the time. A person will buy a property from you and pay you what it is worth, but he wants some consideration; and he will not continue to pay you for what it is supposed to be worth, and only get half what he pays for, or only get it at the time when it is of the least value to him. Now, those are small things; but I have held to the opinion that to go into all those details of the ways in which you rent your lights, and employ people to switch them off, or any other means that can be devised to do it, is an item of expense that does not pay. That is, it does not pay for what you get in return, and there is no element of discipline which is going to be an auxiliary or a collateral advantage resulting to us.

I do not think that there is a very general or a high appreciation put upon the methods of arriving at just what your product costs you. I think that this is recognized in the incandescent work, but not in the arc work. As long as I have been connected with this association, and as large an acquaintance as I have among

because they want the lights most at that time. But in the summer time people discontinue the use along about the 1st of March, April, May or June, and so you have an idle lamp during the summer, in which you have your money invested, waiting until the fall season comes around again in all probability. I contend that the user of that lamp has no right to expect to get that light at the same price per diem as the man who pays you for a service of 312 nights in the year. But that is almost universally done. There is just as much reason for a graduated scale of prices, based upon the amount of service you get from your customers, as there is for fixing the price for a ten o'clock circuit, a twelve o'clock circuit or an all-night circuit. There is just the same principle involved. When that first became apparent to me the first effort I made to equalize the prices on that basis showed me that there was really nothing to go upon excepting guess-work. After the first year's experience I had the result of my own experience to go by, by means of which I could work it out probably in a little better shape. But I found myself doing an injustice to my customers when I thought I was doing an injustice to myself.

A readjustment of those prices on what I worked out on the basis of an all-year contract for an all-night lamp—a lamp that would render me 312 nights of service of ten hours each, and give me the most continuous service, is the one that I started with; but I found that I was charging more people too much on that basis than I was charging, in point of number, too little. It puts the company in the position of making a uniform contract, in which they can say to every customer, or to every person that comes into the office, piece of machinery is subjected when constantly operated above its normal working capacity. Again the manufacturer may contemplate an increase in his plant in the near future, and, in buying a motor, will provide one of sufficient capacity to operate his prospective increase.

To illustrate graphically the practical operations of motors under load, I have taken a large number of records of motors in actual service and from these records have laid out ampère curves or daily load diagrams, which will illustrate very clearly the fluctuations in the current supplied to motors in actual practice. Other interesting features of these curves are the maximum, minimum and average readings as related to each other; the current consumed in driving the shafting as related to the average current consumed; and the peculiarity of the records of motors operating elevators.

Copies of these load records are illustrated in the accompanying diagrams. The vertical lines of these charts, you will notice, represent hours of the day, and the horizontal lines, ampères. In making these records an ampèremeter was placed in the circuit in series with the motor and each reading taken was dotted on the chart where the ampère line, corresponding with the reading taken, intersected the hour line corresponding with the time at which the reading was taken. By connecting these dots together with a continuous line we, of course, obtain the diagrams or curves shown.

The highest average use shown in any of these records is in diagram No. 2, with an average use of 81 per cent. of the capacity of the motor; this record also shows an overload of 44 per cent. at the 2 P. M. reading. Diagram No. 16 shows the lowest average, it be-

ing in this case but 24 per cent. of the capacity of the motor. A composite average of all these records shows that the average use of an electric motor is but 43.57 per cent. of its rated capacity.

It is a fact that many central stations which still use a "maximum or motor capacity system" of charges have adopted a schedule with the fact in view that where the motor is used for the usual run of intermittent work its average use is much below its capacity. The circumstances of motor use are, however, so varied that a system of rates or charges for power which shall better adapt itself to this wide range of conditions has already been adopted by many central stations, especially those operating constant potential power circuits. This system of charges I will call the "maximum reading system," which is based on the maximum reading of an ampèremeter in series with the motor. The station supplying the power reserves the right in their contract with the customer to change or modify the charge for power from time to time as any increase is shown by these readings.

To illustrate more clearly this "maximum reading system" I would refer to diagram No. 23, which is a fair average record. This represents the record of a 15 h. p. motor operating lithograph presses, etc., the maximum reading in this case being 75 ampères, or, approximately, 10 h. p. The user is given a 10 h. p. rate, which in this case happens to be $60 per month, or a rate of $6 per month per horse power based on maximum readings. As the average power delivered to this user is but 67 per cent. of the maximum reading, the station actually receives at this nominal rate of $6 per horse power an actual rate of $9 per month per horse power for the power actually delivered.

The central station supplying this particular motor has adopted the "maximum reading system," and this rate of $6 per month per horse power is their standard charge for motors showing a reading of 5 h. p. and over up to 15 h. p. From 15 h. p. up their charge is $5 per month per horse power. Their monthly bills are also subject to a discount of 5 per cent., I believe, if paid promptly on the first of each month.

To return again to the diagrams. The records, twenty-nine in number, are of so varied a character that an average taken from all the records will, I think, show within 1 per cent. or 2 per cent. of the general average conditions found in electric motor practice. The conditions as shown by these records are as follows:

Average load on motor, 43.57 per cent. of its capacity.

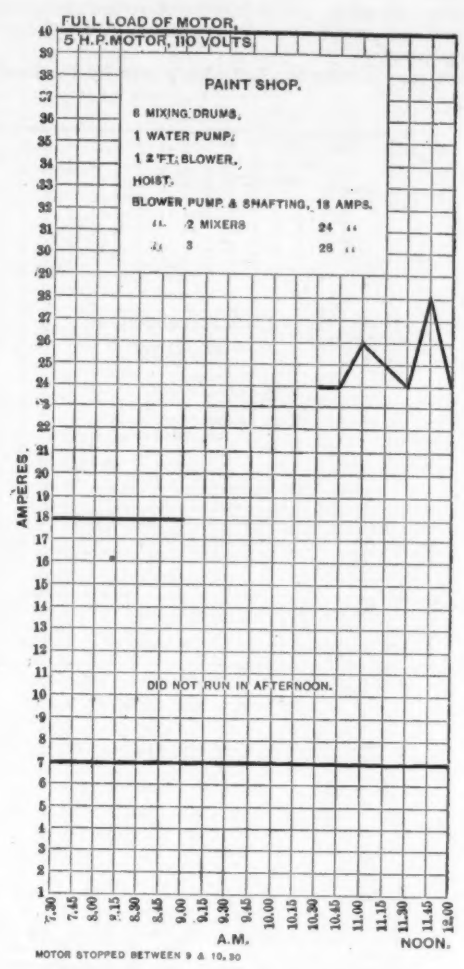
Maximum load on motor, 68.24 per cent. of its capacity.

Average load on motor, 64 per cent. of maximum load.

Reducing these averages to dollars and cents we have the following results:

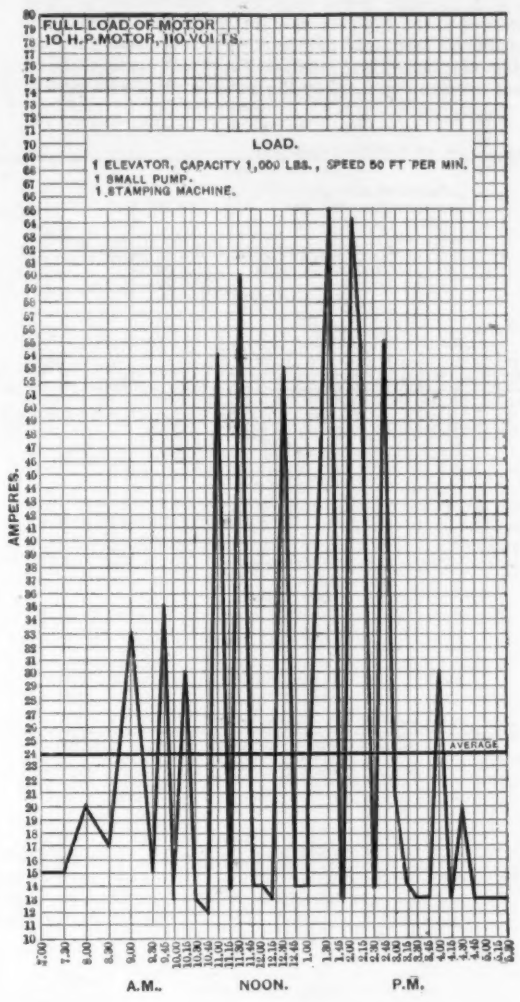
A "maximum capacity" rate of $6 per month per horse power pays the station $13.80 per month per horse power for the power actually delivered. A "maximum reading" rate of $6 per month per horse power pays the station $9.37 per month per horse power for the power actually delivered.

$13.80 per month per h. p. is certainly a tempting price for power, but it is open to some serious objections. In the first place, at this price the electric motor, even with its much higher efficiency, cannot compete with the gas engine. A good gas engine uses about



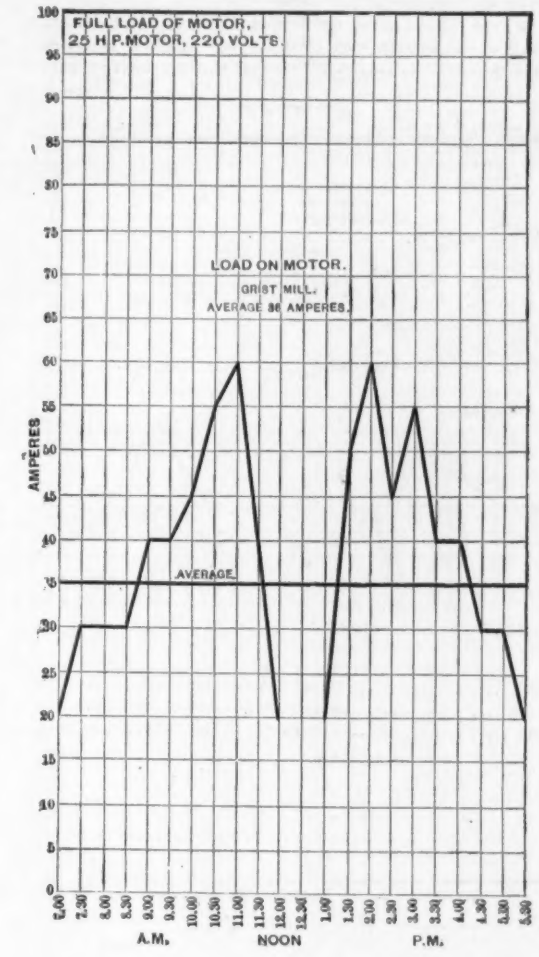
Average Load.....17½ per cent. of Rated Capacity.
Maximum Load.....70 per cent. of Rated Capacity.
Average Load.....25 per cent. of Maximum Load.
Shafting.....— per cent. of Average Load.

No. 4.



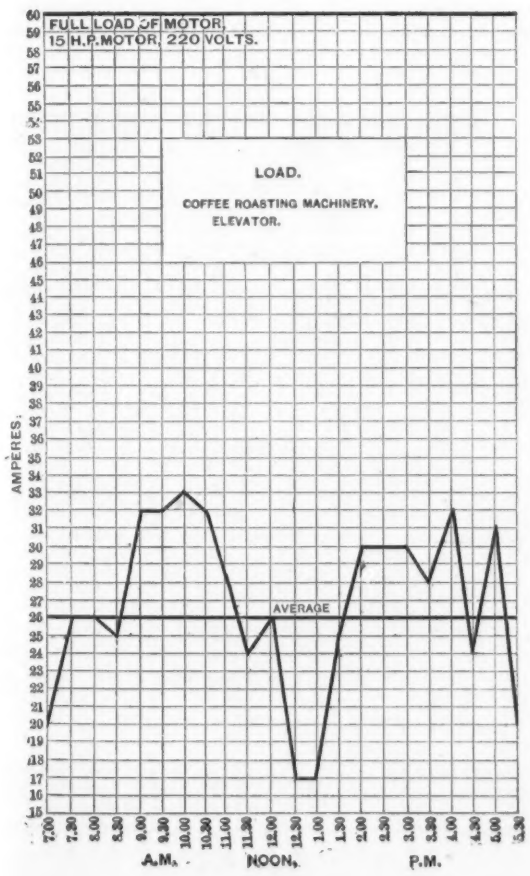
Average Load.....30 per cent. of Rated Capacity.
Maximum Load.....81 per cent. of Rated Capacity.
Average Load.....37 per cent. of Maximum Load.

No. 6.



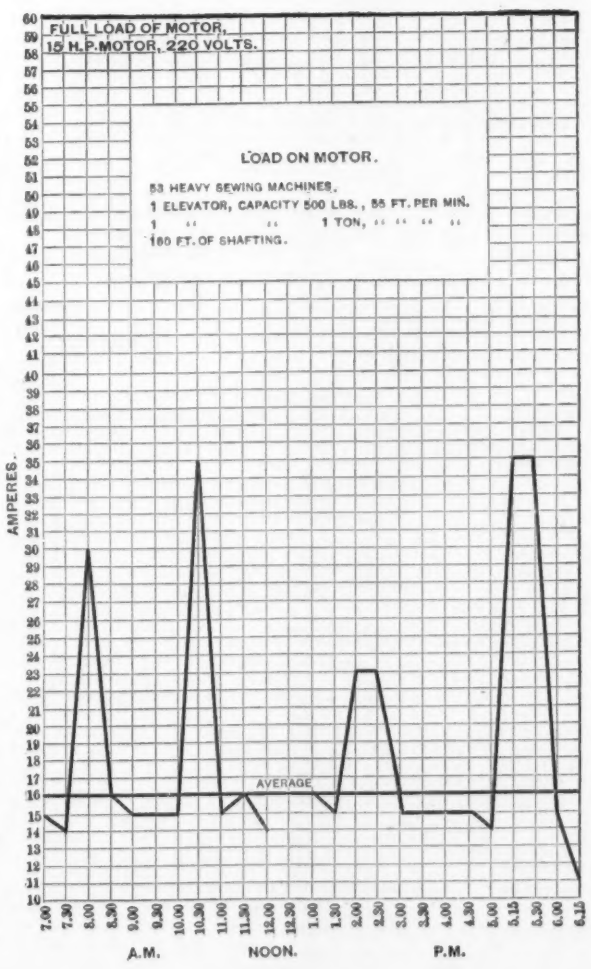
Average Load.....35 per cent. of Rated Capacity.
Maximum Load.....60 per cent. of Rated Capacity.
Average Load.....58 per cent. of Maximum Load.
Shafting.....58 per cent. of Average Load.

No. 8.



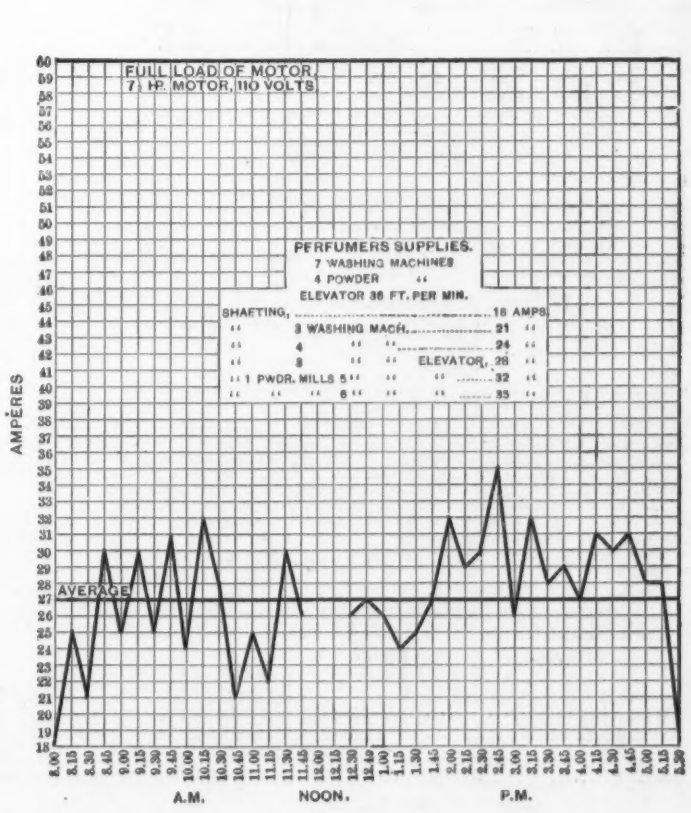
Average Load.....43½ per cent. of Rated Capacity.
Maximum Load.....55 per cent. of Rated Capacity.
Average Load.....78 per cent. of Maximum Load.
Shafting.....65 per cent. of Average Load.

No. 5.



Average Load.....26 per cent. of Rated Capacity.
Maximum Load.....58 per cent. of Rated Capacity.
Average Load.....46 per cent. of Maximum Load.
Shafting.....71 per cent. of Average Load.

No. 7.



Average Load.....45 per cent. of Rated Capacity.
Maximum Load.....58 per cent. of Rated Capacity.
Average Load.....77 per cent. of Maximum Load.
Shafting.....66 per cent. of Average Load.

No. 9.

VARIATIONS OF LOAD IN ELECTRIC MOTOR SERVICE, ILLUSTRATING MR. LUFKIN'S PAPER.

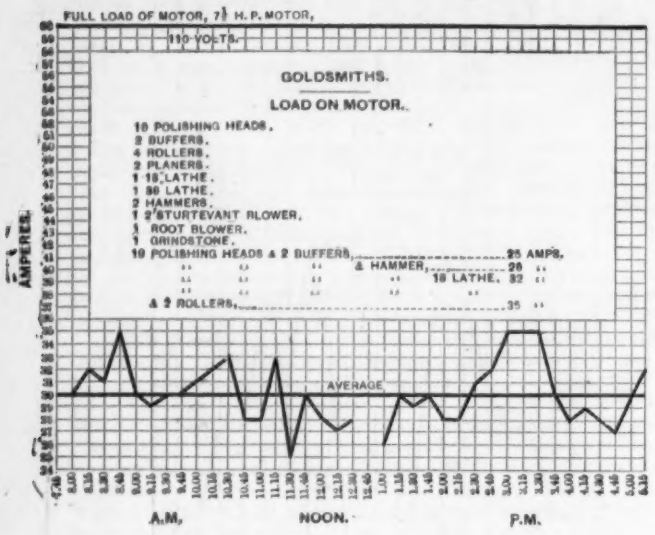
20 feet of gas per hour per horse power, or about 5,200 cubic feet per month. Giving gas at $1.50 per thousand (and in many places it is much lower than this), the gas engine will deliver power at a cost of $7.80 per month per horse power. We can, without much trouble, obtain the $9.37 rate per month for a motor in competition with the gas engine, on account of its many and obvious advantages, but we can seldom obtain the $13.80 rate. This maximum capacity rate also very much hampers the user in the selection of a motor, and the motor salesman, in order surely to effect a sale, is very apt to underrate the prospective load on the motor, as the customer is governed in his purchase of a machine much more by the monthly charge than by the first cost of the motor.

Another feature which must not be lost sight of is the fact that a motor user who has bought and paid for his machine becomes your permanent customer, his income being entirely derived from you are familiar in theory, but which has, I believe, never before been practically illustrated, namely, the counter E.M.F. in the armature of a shunt wound motor driving a spur gear elevator. When the elevator is coming down with a load the counter E.M.F. runs above the E.M.F. of the supplying circuit, and therefore the motor becomes a producer instead of a consumer, and thus acts as a brake to retard the too rapid descent of the elevator.

Diagram No. 3 represents the record of a 7½ h. p. motor in a wine merchant's store operating an elevator, a small piston water pump and wine pump. The water pump is in continuous operation, the wine pump and elevator being only used intermittently. The current consumed in the shafting and water pump, which constitute the continuous load, is 14 ampères. The difference between this 14 ampères and the several readings below that amount, shows the amount of current generated by the motor when the elevator is and several wood-working machines, such as planers, crosscut saws, etc. In our machine department, the several motors run several lines of shafting independent of each other. In this department we run heavy planers, lathes, drill presses, shapers, slotters, gear-cutters and other machinery necessary to a complete machine shop. A motor in our department for fine woodwork furnishes power for the various machines necessary to the manufacture of articles needing turning lathes, gig-saws, rip-saws, etc.

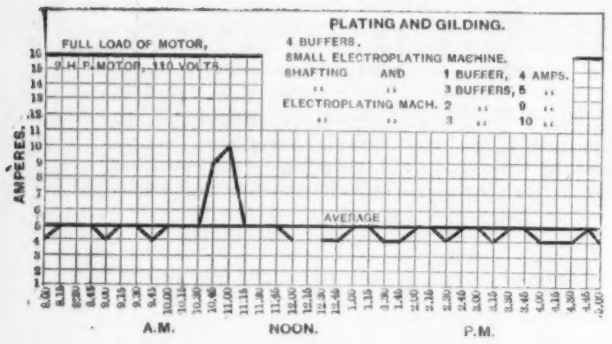
"In our experimental department and show room, we use a smaller motor set with the necessary speed reducing pulleys and belts upon a movable frame. These we roll from place to place as convenience dictates. All of these motors are giving us unqualified satisfaction, and we would not willingly return to direct steam engine power."

The company is being supplied with power by the local electric



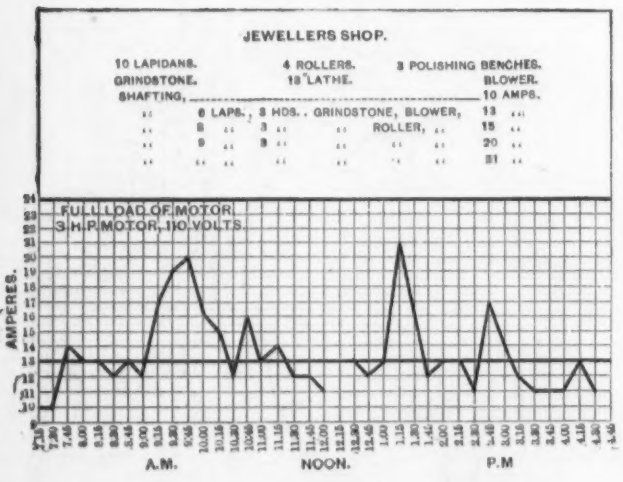
Average Load.....50 per cent. of Rated Capacity.
Maximum Load.....58 per cent. of Rated Capacity.
Average Load.....76 per cent. of Maximum Load.

No. 10.



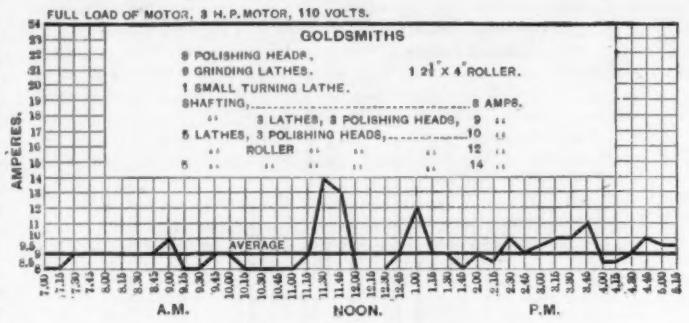
Average Load.....31 per cent. of Rated Capacity.
Maximum Load.....63 per cent. of Rated Capacity.
Average Load.....50 per cent. of Maximum Load.
Shafting.....80 per cent. of Average Load.

No. 11.


JEWELLERS SHOP.
10 LAPIDANS. 4 ROLLERS. 3 POLISHING BENCHES.
GRINDSTONE. 18" LATHE. BLOWER.
SHAFTING, ... 10 AMPS.
" 6 LAPS., 3 HDS., GRINDSTONE, BLOWER, 13 "
" 8 " 3 " " ROLLER, " 15 "
" 9 " 3 " " " " 20 "
" " " " " " " 21 "
FULL LOAD OF MOTOR, 3 H.P. MOTOR, 110 VOLTS.
AMPERES.
A.M.
NOON.
P.M

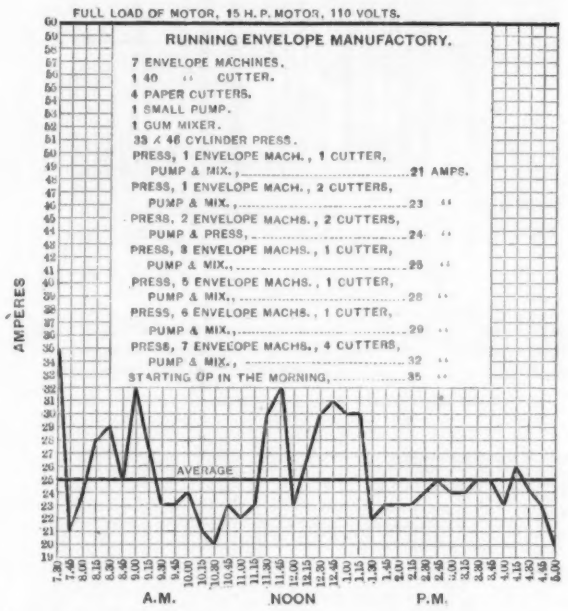
Average Load.....54 per cent. of Rated Capacity.
Maximum Load.....87½ per cent. of Rated Capacity.
Average Load.....62 per cent. of Maximum Load.
Shafting.....78 per cent. of Average Load.

No. 12.


FULL LOAD OF MOTOR, 3 H.P. MOTOR, 110 VOLTS.
GOLDSMITHS
3 POLISHING HEADS.
3 GRINDING LATHES. 1 2½" X 4" ROLLER.
1 SMALL TURNING LATHE.
SHAFTING, ... 8 AMPS.
" 3 LATHES, 3 POLISHING HEADS, 9 "
5 LATHES, 3 POLISHING HEADS, ... 10 "
" ROLLER " " " 12 "
5 " " " " " 14 "
AMPERES.
AVERAGE
A.M.
NOON.
P.M.

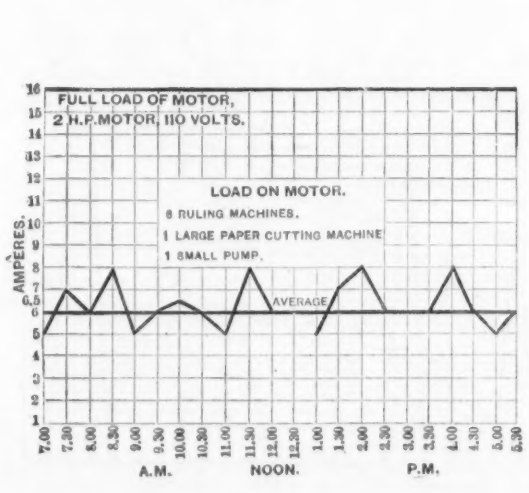
Average Load .....57½ per cent. of Rated Capacity.
Maximum Load.....59 per cent. of Rated Capacity.
Average Load.....64 per cent. of Maximum Load.
Shafting.....89 per cent. of Average Load.

No. 13.


FULL LOAD OF MOTOR, 15 H.P. MOTOR, 110 VOLTS.
RUNNING ENVELOPE MANUFACTORY.
7 ENVELOPE MACHINES.
1 40 " CUTTER.
4 PAPER CUTTERS.
1 SMALL PUMP.
1 GUM MIXER.
33 X 46 CYLINDER PRESS.
PRESS, 1 ENVELOPE MACH., 1 CUTTER, PUMP & MIX., ... 21 AMPS.
PRESS, 1 ENVELOPE MACH., 2 CUTTERS, PUMP & MIX., ... 23 "
PRESS, 2 ENVELOPE MACHS., 2 CUTTERS, PUMP & PRESS, ... 24 "
PRESS, 3 ENVELOPE MACHS., 1 CUTTER, PUMP & MIX., ... 26 "
PRESS, 5 ENVELOPE MACHS., 1 CUTTER, PUMP & MIX., ... 28 "
PRESS, 6 ENVELOPE MACHS., 1 CUTTER, PUMP & MIX., ... 29 "
PRESS, 7 ENVELOPE MACHS., 4 CUTTERS, PUMP & MIX., ... 32 "
STARTING UP IN THE MORNING, ... 35 "
AMPERES
AVERAGE
A.M.
NOON
P.M.

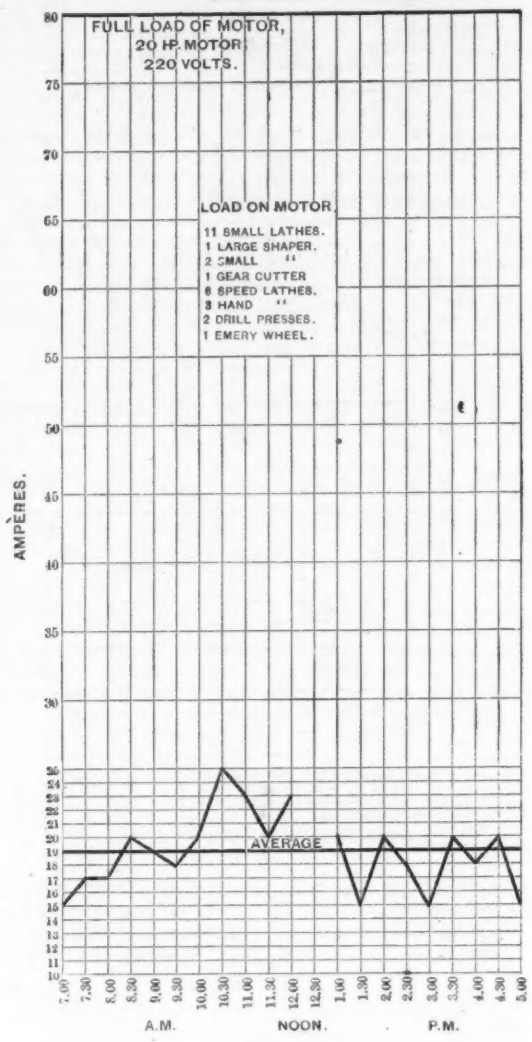
Average Load .....41½ per cent. of Rated Capacity.
Maximum Loa l.....58 per cent. of Rated Capacity.
Average Load.....71½ per cent. of Maximum Load.
Shafting.....80 per cent. of Average Load.

No. 14.



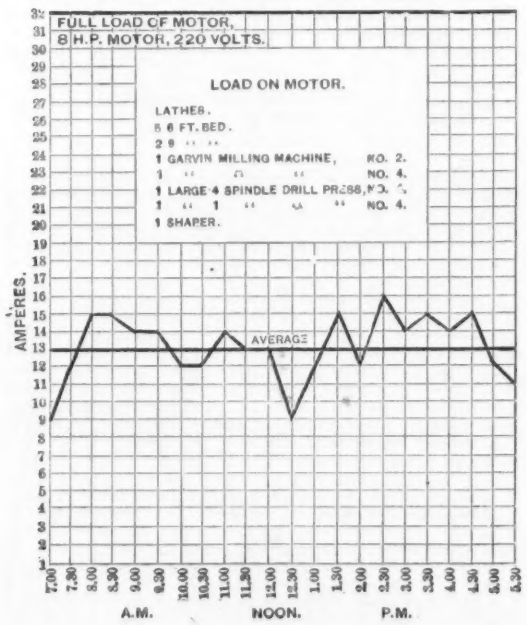
Average Load .....39 per cent. of Rated Capacity.
Maximum Load.....50 per cent. of Rated Capacity.
Average Load.....75 per cent. of Maximum Load.
Shafting.....85 per cent. of Average Load.

No. 15.



Average Load.....24 per cent. of Rated Capacity.
Maximum Load.....31 per cent. of Rated Capacity.
Average Load.....76 per cent. of Maximum Load.
Shafting.....79 per cent. of Average Load.

No. 16.



Average Load.....40 per cent. of Rated Capacity.
Maximum Load.....50 per cent. of Rated Capacity.
Average Load.....81 per cent. of Maximum Load.
Shafting.....70 per cent. of Average Load.

No. 18.

VARIATIONS OF LOAD IN ELECTRIC MOTOR SERVICE, ILLUSTRATING MR. LUFKIN'S PAPER.

the product of the work of his motor. His bills for power you are also sure of collecting, for the moment his power is shut off his earning capacity ceases. The motor becomes to him an absolute necessity instead of a seasonable luxury, as is the case with many electric lights.

Another very remarkable feature brought out by these diagrams is the fact that the average power consumed in doing serviceable work is but three-eighths of the total power used, and the remaining five-eighths (68%) is consumed in driving shafting. This enormous loss in shafting would indicate that the day may not be far distant when each machine will be equipped with its own direct-geared motor and that the days of shafting and belting are numbered.

As a concluding reference to these diagrams, let me call your attention to diagram No. 3, in which a condition presents itself with which coming down. As this class of elevator is largely used, this peculiar fact becomes an item of considerable importance to the central station, and is also a strong argument in favor of a constant potential power circuit, as only on this circuit can these conditions be obtained.

I had hoped to prepare some diagrams of motors on series or arc light circuits for comparison with the records here submitted, and thereby illustrate graphically the advantages of the constant potential circuit for power distribution. Want of time has, however, prevented this.

In conclusion, let me read you some extracts from a letter received in March last from a prominent manufacturing corporation using 75 or 80 h. p. in motors in their workshops:

"We are running with one motor a large 4-ton Graves' elevator light company, on a basis of $50 per year per horse power, based on maximum readings. The user is apparently delighted with his service and perfectly satisfied with the cost of his power, and I have the assurance of the electric light company supplying the power, that they would be glad to load their plant under the same terms given this customer.

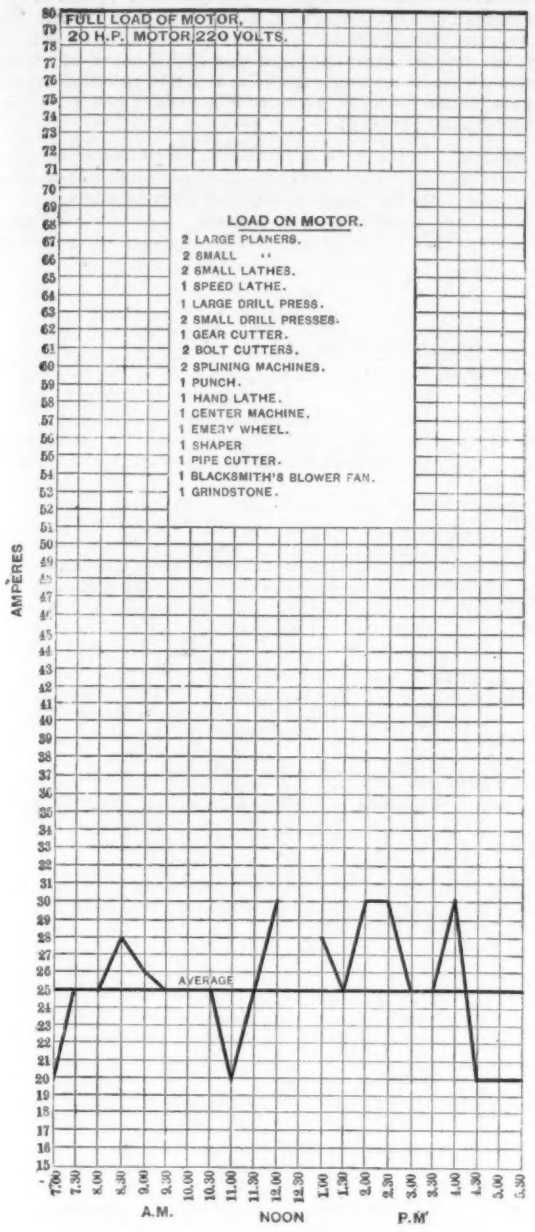
Mr. WIRT: I think the writer of this paper is a little bit too fair to the gas engine. I am not very familiar with those figures at present—not as familiar with them as I was at one time—but I think it would be a very large gas engine—a very good gas engine to give a horse power for 20 feet. I was talking a little to a gas expert, and he told me that with some kind of gas it would burn as high as 50 feet—that was fuel gas. I remember the result of

a test where 22 feet was used per horse power per hour, but I would not expect to get that result with commercial work and small engines.

Mr. GARRATT: May the apparent discrepancy not be this—that the figure of 20 feet for horse power of gas engine meant on an intermittent load?

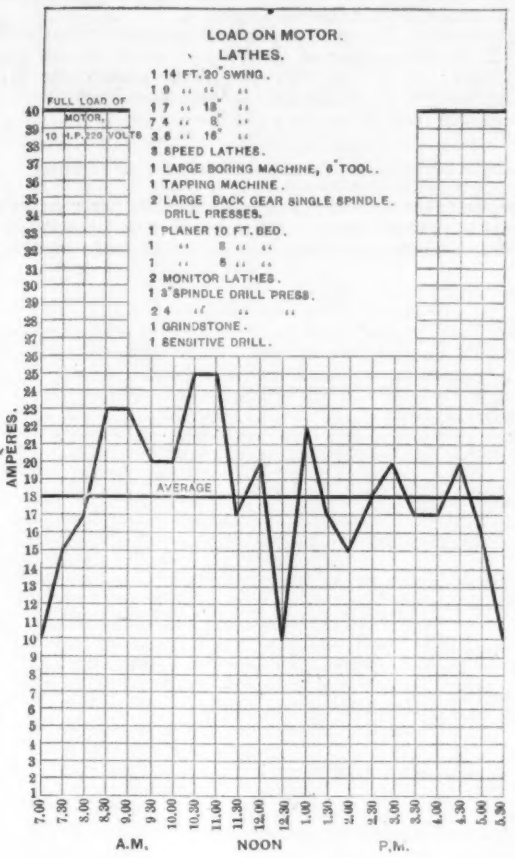
Mr. FABEN: The Otto gas engine people of Philadelphia, the observations of a number of engines running with 10 h. p. and less, which ran with about 1,200 feet of gas per ten hours. That was on the basis of a 10 horse engine.

Dr. LOUIS BELL: I have some little interest in this question of the gas engine for the reason that the gas engine seems to be the principal opponent of the electric motor for light work. In all of the tests that I have ever figure was sometimes slightly better. Then, further, it is interesting to raise the question as to whether this so-called 20 feet per horse power hour is brake horse power hour or indicated horse power hour. Any of you who are familiar with the diagrams given by gas engines on indication are only too well aware that the light load diagram of a gas engine is by no



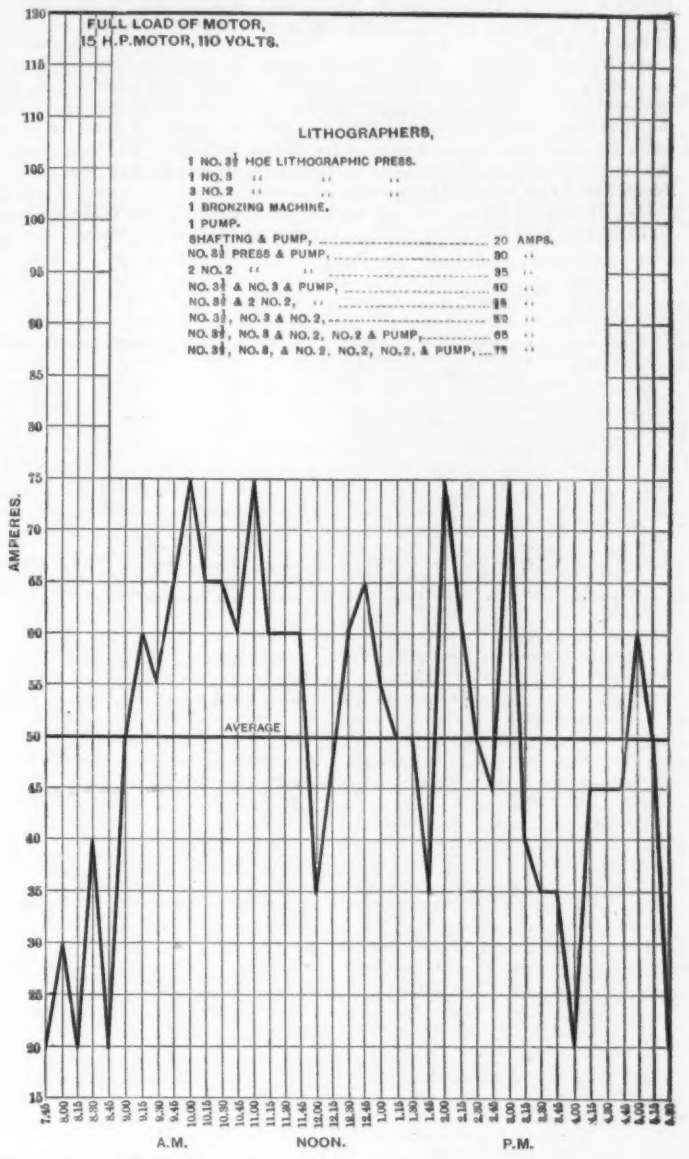
Average Load.....32½ per cent. of Rated Capacity.
Maximum Load.....37½ per cent. of Rated Capacity.
Average Load.....83 per cent. of Maximum Load.
Shafting.....80 per cent. of Average Load.

No. 17.


LOAD ON MOTOR.
LATHES.
1 14 FT. 20" SWING.
1 9 " " "
1 7 " 18" "
7 4 " 8" "
3 6 " 16" "
3 SPEED LATHES.
1 LARGE BORING MACHINE, 6" TOOL.
1 TAPPING MACHINE.
2 LARGE BACK GEAR SINGLE SPINDLE DRILL PRESSES.
1 PLANER 10 FT. BED.
1 " 8 " "
1 " 5 " "
2 MONITOR LATHES.
1 3" SPINDLE DRILL PRESS.
2 4 " " "
1 GRINDSTONE.
1 SENSITIVE DRILL.
FULL LOAD OF MOTOR. 10 H.P. 220 VOLTS
AMPÈRES.
AVERAGE
A.M. NOON P.M.

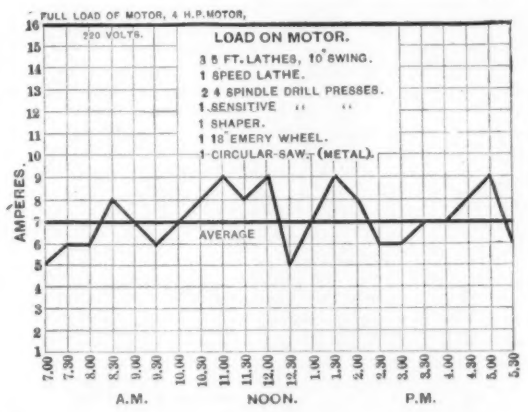
Average Load.....45 per cent. of Rated Capacity.
Maximum Load.....62½ per cent. of Rated Capacity.
Average Load.....72 per cent. of Maximum Load.
Shafting.....56 per cent. of Average Load.

No. 20.


FULL LOAD OF MOTOR, 15 H.P. MOTOR, 110 VOLTS.
LITHOGRAPHERS.
1 NO. 3½ HOE LITHOGRAPHIC PRESS.
1 NO. 3 " " "
3 NO. 2 " " "
1 BRONZING MACHINE.
1 PUMP.
SHAFTING & PUMP, ... 20 AMPS.
NO. 3½ PRESS & PUMP, ... 30 "
2 NO. 2 " " ..... 35 "
NO. 3½ & NO. 3 & PUMP, ... 40 "
NO. 3½ & 2 NO. 2, " ..... 45 "
NO. 3½, NO. 3 & NO. 2, ... 50 "
NO. 3½, NO. 3 & NO. 2, NO. 2 & PUMP, ... 65 "
NO. 3½, NO. 3, & NO. 2, NO. 2, NO. 2, & PUMP, ... 75 "
AMPERES.
AVERAGE
A.M. NOON. P.M.

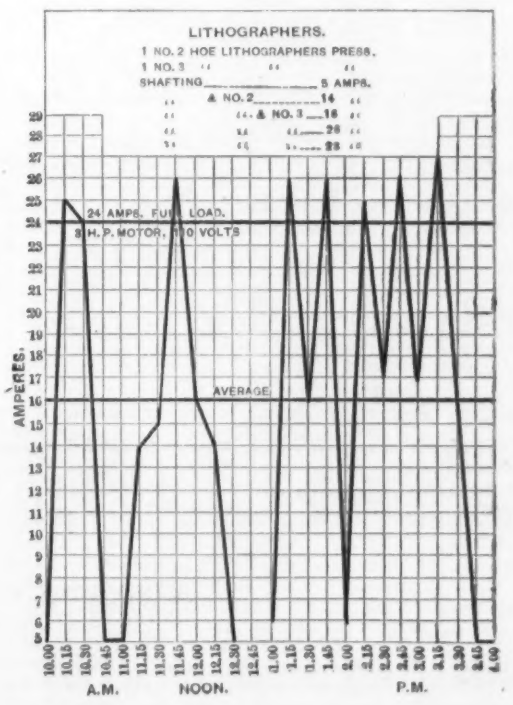
Average Load.....42 per cent. of Rated Capacity.
Maximum Load.....6½ per cent. of Rated Capacity.
Average Load.....67 per cent. of Maximum Load.
Shafting.....40 per cent. of Average Load.

No. 23.



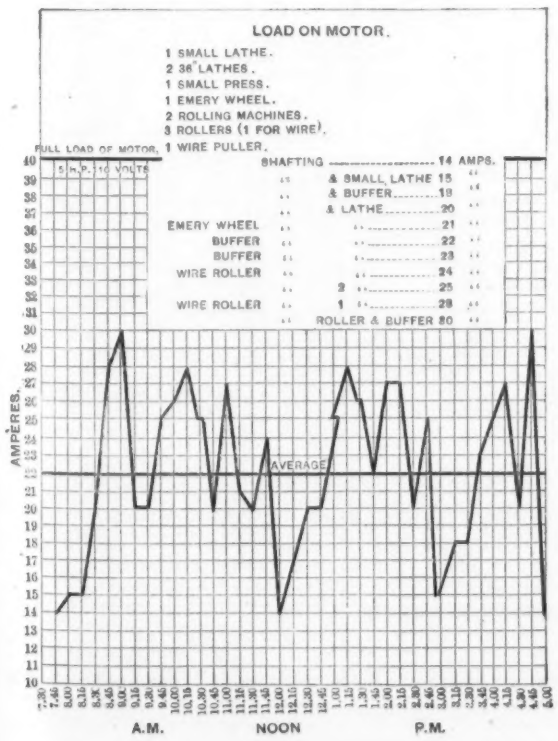
Average Load.....45 per cent. of Rated Capacity.
Maximum Load.....56 per cent. of Rated Capacity.
Average Load.....77 per cent. of Maximum Load.
Shafting.....70 per cent. of Average Load.

No. 21.


LITHOGRAPHERS.
1 NO. 2 HOE LITHOGRAPHERS PRESS.
1 NO. 3 " "
SHAFTING ..... 5 AMPS.
" & NO. 2 ..... 14 "
" " & NO. 3 ..... 16 "
" " ..... 20 "
" " ..... 23 "
24 AMPS. FULL LOAD.
3 H.P. MOTOR, 110 VOLTS
AMPERES.
AVERAGE
A.M. NOON. P.M.

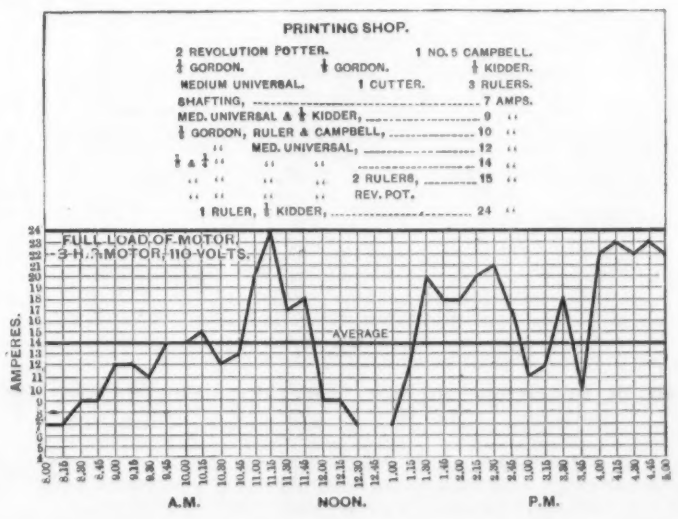
Average Load.....67 per cent. of Rated Capacity.
Maximum Overload.....12½ per cent. of Rated Capacity.
Average Load.....59 per cent. of Maximum Load.
Shafting.....39 per cent. of Average Load.

No. 22.


LOAD ON MOTOR.
1 SMALL LATHE.
2 36" LATHES.
1 SMALL PRESS.
1 EMERY WHEEL.
2 ROLLING MACHINES.
3 ROLLERS (1 FOR WIRE).
1 WIRE PULLER.
FULL LOAD OF MOTOR, 5 H.P. 110 VOLTS
SHAFTING ..... 14 AMPS.
" & SMALL LATHE 15 "
" & BUFFER ..... 18 "
" & LATHE ..... 20 "
EMERY WHEEL " " ..... 21 "
BUFFER " " ..... 22 "
BUFFER " " ..... 23 "
WIRE ROLLER " " ..... 24 "
" 2 " ..... 25 "
WIRE ROLLER " 1 " ..... 28 "
" ROLLER & BUFFER 30 "
AMPERES.
AVERAGE
A.M. NOON P.M.

Average Load.....55 per cent. of Rated Capacity.
Maximum Load.....75 per cent. of Rated Capacity.
Average Load.....74 per cent. of Maximum Load.
Shafting.....61 per cent. of Average Load.

No. 19.


PRINTING SHOP.
2 REVOLUTION POTTER. 1 NO. 5 CAMPBELL.
½ GORDON. ½ GORDON. ½ KIDDER.
MEDIUM UNIVERSAL. 1 CUTTER. 3 RULERS.
SHAFTING, ... 7 AMPS.
MED. UNIVERSAL & ½ KIDDER, ... 9 "
½ GORDON, RULER & CAMPBELL, ... 10 "
" MED. UNIVERSAL, ... 12 "
½ & ½ " " ..... 14 "
" " " 2 RULERS, ... 15 "
" " " REV. POT.
1 RULER, ½ KIDDER, ... 24 "
FULL LOAD OF MOTOR, 3 H.P. MOTOR, 110 VOLTS.
AMPERES.
AVERAGE
A.M. NOON. P.M.

Average Load.....58 per cent. of Rated Capacity.
Maximum Load.....100 per cent. of Rated Capacity.
Average Load.....60 per cent. of Maximum Load.
Shafting.....50 per cent. of Average Load.

No. 24.

VARIATIONS OF LOAD IN ELECTRIC MOTOR SERVICE, ILLUSTRATING MR. LUFKIN'S PAPER.

who make the gas engine, will warrant that the engine will not consume to exceed 21½ feet per hour per horse power with an average commercial illuminating gas. Experiments were made in New York by the *Popular Science Monthly* in treating domestic motors. They cited that fact of 21½ feet; but the experience had rarely shown that that quantity was consumed. It ran less than that. I have seen which were at all of an authoritative character, I should say that 20 feet per horse power hour was a minimum figure, and not only a minimum figure but one considerably below the usual minimum. I have had occasion to handle in the last year and a half a large number of tests both in this country and in Europe, and very few of them showed less than 23 or 24 feet of gas, although the means lean. It shows a very considerable consumption of power, and the only proper test for efficiency in gas per horse power hour is in brake horse power. The indicated horse power hour of a gas engine is not at all comparable in most cases to the indicated horse power hour of a steam engine. As a rule the friction comes in to play a much more important part; and further, the

amount of oil used in gas engines is very considerable, so that in one prominent test in England a short time since an allowance of some 5 feet of gas per horse power hour was made to cover the extra consumption of oil---that is nominally---the gas being say, 23 feet per horse power hour, it was considered fair to call the real consumption, to bring it down to gas basis, 27 or 28 feet on account of the extra amount of oil. A very considerable number of tests of small engines have been made, and although the lowest possible figures approximate somewhat nearly to those given, the average is very much higher---frequently nearer 30 feet than 20.

Mr. WIRT: The gas engine uses water in considerable quantity. In some cases this expense would be well worth taking into account. Another matter with the gas engine is providing for the exhaust—there must be a large free exhaust, and this exhaust can be loaded to a point which makes it dangerous in regard to fire and which makes it necessary to protect it thoroughly.

Mr. EDGAR: I have listened with a great deal of interest to this article of Mr. Lufkin, because I have talked the matter over with him to a great extent, and I know that a great many of his curves were made from motors running from our station. Our efforts in the last year and a half to two years have been to sell motors entirely by meter, selling it by the absolute horse power hour; and of the last 400 horse power which have been used in Boston, I should think that 250 are now paying for their current entirely by meter at so much a horse power hour. We make a nominal charge of 10 cents an hour per horse power, making discounts from this down to 40 per cent., so that the minimum rate is 6 cents per hour, the average being between 7 and 8. This is irrespective of the size of the motor. It depends entirely on the number of horse power hours per day as compared with the maximum which that motor can generate. In other words, a 1 h. p. motor might get just as good a rate as a 30 h. p. motor provided it used as much as its maximum, as if it were a larger motor. I think that the question of charging by the nominal capacity of the motor is something never heard of. Our station has never tried to charge in that way. It has always charged by the maximum load of the motor. In other words a man could put in any motor he pleased; he would simply be charged, when he was charged by contract, the maximum power which that motor used at any time by means of the ampère meter. If a person was going to use 5 h. p., and he was inclined to put in a 10 h. p. motor we were very glad to have him do so, and we would only charge for the 5 h. p. if he used only 5 h. p. I never heard of a case where a person was charged for 10 merely because he happened to put in a 10 rather than a 5.

The PRESIDENT: The next paper will be on standards of economy in the generation of power and steam under the best conditions. It will be presented by the author, Mr. H. N. Swetland, editor of *Power and Steam*, New York.

Mr. Swetland read his paper as follows:

STANDARDS OF ECONOMY IN THE GENERATION OF POWER.

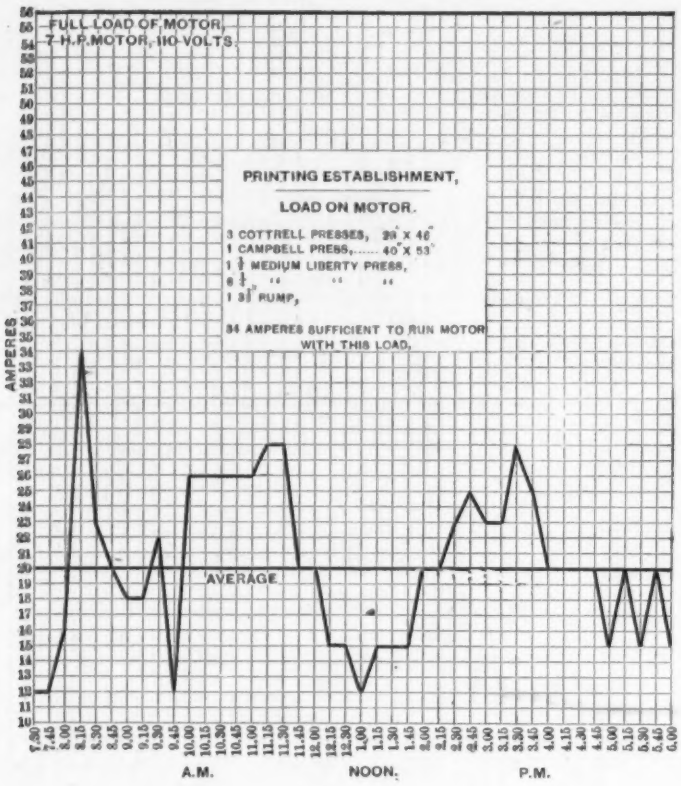
In suggesting to our secretary the subject for this paper as one which would be of vital interest to the members of this association I had no idea that I should be called upon to prepare and present it, but the subject of economy in general has received the attention of our best thought, but it has been directed to the operations of the complete system, and too often details of definite expense are overlooked by the superintendent, whose imperative duty is the running of the plant, not its most economical methods. He is obliged to keep a station in smooth running order to furnish good, steady, reliable lights, under pressure of constant demand, in which case economy is not the first consideration.

At the last convention the admirable paper read by Mr. T. Carpenter Smith, of Philadelphia, entitled "A System of Central Station Accounts," touched upon and almost comprehended this necessity, but he still further included the maintenance of outside equipment, whereas my paper is confined to the question of first cost of production of power expressed in pounds of fuel per developed horse power per hour.

The material for the data in furnishing standards of economy should naturally be the practical results of actual operations compiled in tables from the results obtained by different managers. To what end? They would interest and benefit all desirous of investing in electric light and power enterprises which are becoming such an attractive feature in the financial world. They would be useful to prevent the establishment of unnecessary and injurious competition frequently induced by statements of facts and figures showing an utterly false and unattainable economy.

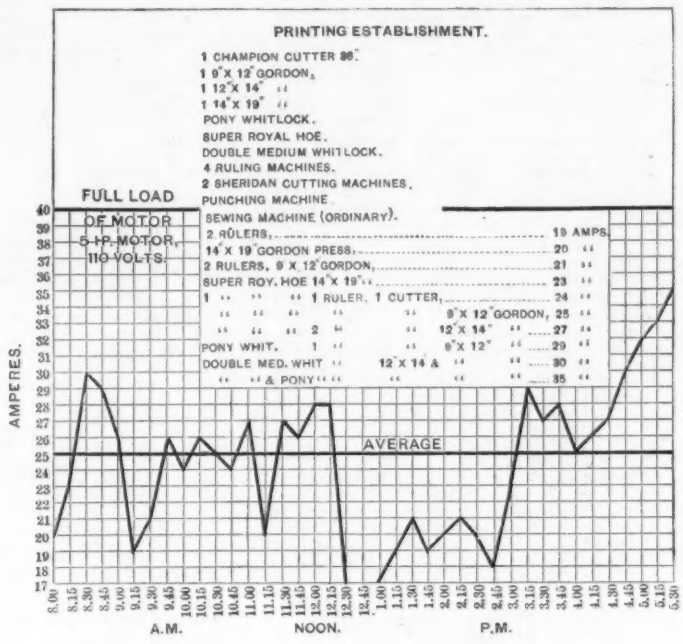
But to the superintendent of the station, more than any other person, these tables would be of paramount importance. They would enable him at a glance to learn what others are actually accomplishing under certain named conditions, and readily to institute comparisons with his own records. By their use he would not only gain enlightenment on many points, but be stimulated to the highest possible degree of efficiency and economy. He would also thus be furnished with unimpeachable authority to offer a doubting stockholder or too exacting president who, while perhaps not being initiated in the details of practical workings, is always glad to be reassured by accurate information.

These tables would not, however, be found elastic enough to suit the purpose of the energetic boomer whose object in building a station is sale, not operation, for they will be found to show the necessity of the best modern appliances to the most economical production of power. Neither would they be particularly interesting reading to men who trade in inferior appliances.



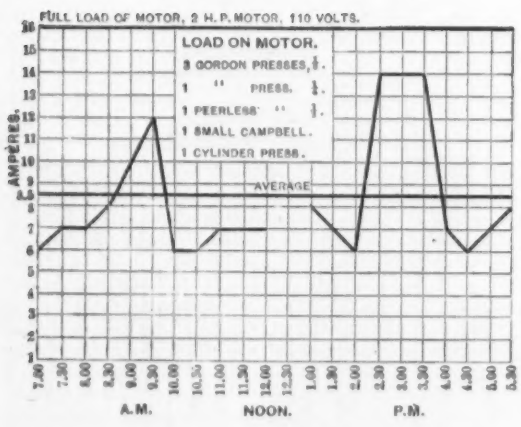
Average Load.....36 per cent. of Rated Capacity.
Maximum Load.....61 per cent. of Rated Capacity.
Average Load.....58½ per cent. of Maximum Load.
Shafting.....60 per cent. of Average Load.

No. 27.


PRINTING ESTABLISHMENT.
1 CHAMPION CUTTER 36".
1 9"X 12" GORDON.
1 12"X 14" "
1 14"X 19" "
PONY WHITLOCK.
SUPER ROYAL HOE.
DOUBLE MEDIUM WHITLOCK.
4 RULING MACHINES.
2 SHERIDAN CUTTING MACHINES.
PUNCHING MACHINE
SEWING MACHINE (ORDINARY).
FULL LOAD OF MOTOR 5 H.P. MOTOR, 110 VOLTS.
2 RULERS, ... 19 AMPS.
14"X 19" GORDON PRESS, ... 20 "
2 RULERS, 9 X 12" GORDON, ... 21 "
SUPER ROY. HOE 14"X 19" " ..... 23 "
1 " " " 1 RULER, 1 CUTTER, ... 24 "
" " " " " 9"X 12" GORDON, 25 "
" " " 2 " " 12"X 14" " ..... 27 "
PONY WHIT. 1 " " 9"X 12" " ..... 29 "
DOUBLE MED. WHIT " 12"X 14 & " " ..... 30 "
" " & PONY " " " " ..... 35 "
AMPERES.
AVERAGE
A.M.
NOON.
P.M.

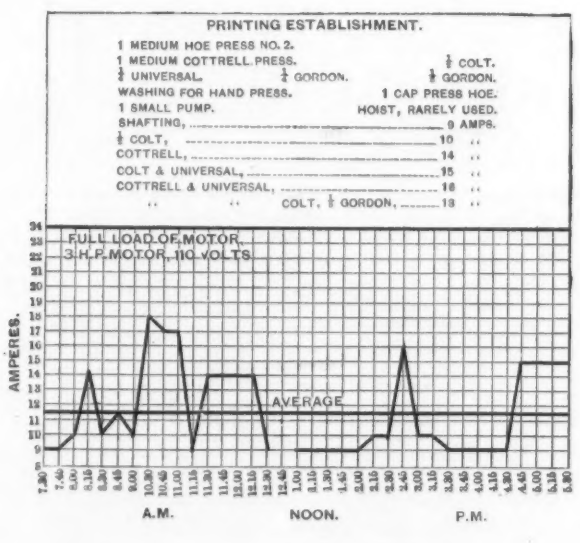
Average Load.....63 per cent. of Rated Capacity.
Maximum Load.....75 per cent. of Rated Capacity.
Average Load.....83 per cent. of Maximum Load.
Shafting.....71 per cent. of Average Load.

No. 29.



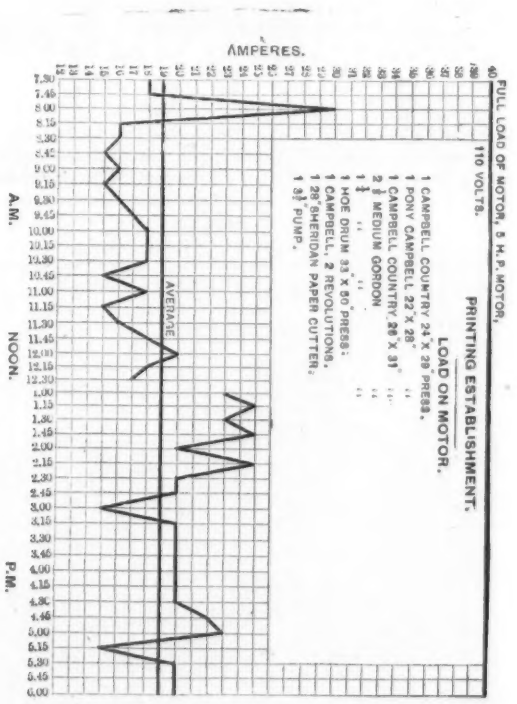
Average Load.....39 per cent. of Rated Capacity.
Maximum Load.....88 per cent. of Rated Capacity.
Average Load.....60 per cent. of Maximum Load.
Shafting.....70 per cent. of Average Load.

No. 25.


PRINTING ESTABLISHMENT.
1 MEDIUM HOE PRESS NO. 2.
1 MEDIUM COTTRELL PRESS.
1/4 UNIVERSAL. 1/4 GORDON. 1/4 COLT. 1/4 GORDON.
WASHING FOR HAND PRESS. 1 CAP PRESS HOE.
1 SMALL PUMP. HOIST, RARELY USED.
SHAFTING, ... 9 AMPS.
1/4 COLT, ... 10 "
COTTRELL, ... 14 "
COLT & UNIVERSAL, ... 15 "
COTTRELL & UNIVERSAL, ... 16 "
" " COLT, 1/4 GORDON, ... 19 "
FULL LOAD OF MOTOR, 3 H.P. MOTOR, 110 VOLTS.
AMPERES.
AVERAGE
A.M.
NOON.
P.M.

Average Load.....48 per cent. of Rated Capacity.
Maximum Load.....75 per cent. of Rated Capacity.
Average Load.....64¼ per cent. of Maximum Load.
Shafting.....79 per cent. of Average Load.

No. 26.



Average Load.....48 per cent. of Rated Capacity.
Maximum Load.....75 per cent. of Rated Capacity.
Average Load.....63 per cent. of Maximum Load.
Shafting.....80 per cent. of Average Load.

No. 28.

VARIATIONS OF LOAD IN ELECTRIC MOTOR SERVICE, ILLUSTRATING MR. LUFKIN'S PAPER.

A "standard of economy" is obtainable only by a combination of mechanism best adapted to the conditions and attendance which can secure from this mechanism the best possible results. A plant may be equipped with the most improved devices, the excellence of which may be practically nullified by neglect of well-known duties, ignorance or mismanagement. A poor gun in the hands of a good soldier is a better combination than a good gun in the hands of a poor soldier. It is not the machine alone, but that combined with the skillful man behind it that works out the best results.

This point was splendidly taken by Mr. Geo. H. Babcock in his most valuable paper on "Boiler Economy" read before us in Kansas City. We all remember his allusion to "boilers and brains," or the "coefficient of common sense."

It is, perhaps, superfluous to mention that results obtained with different existing equipment and attendance vary fully as 1 to 5 with a possibility of the still further lowering of the former proportion by investment in still better equipment, constructed by still greater skill, managed and operated throughout by superior intelligence, and yet these proportions which to-day show such wide results in fuel consumption may by the combination of intelligence, energy and care be made to show results more nearly proportioned to the possibilities of the present equipment by placing on record the best results obtained from a similar system.

Of course no absolute standard or unit of economy can be established by a vote of convention or flat of association. A yard stick is a yard stick, an inch an inch, but a standard of economy must always vary in greater or less degree according to conditions and equipment.

Yet, a sufficient similarity exists to enable us to prepare tables covering the main types of equipment, and the recorded performance of any special type would be relied upon and regarded as a standard.

Human ingenuity, talent, patience, skill and incessant labor are being exerted every day and hour in the direction of lowering the records. The ambition of the day is turned toward producing the maximum of result with the minimum of expenditure.

Standing in comparison with the 15 minutes of the ocean racer, the second clipped from the tables of the turf, or the extra grain made to yield from the refractory ore, is the ounce of fuel measured in the economic generation of power when considered on the large and increasing scale of commercial enterprise.

My plea is for the most minute and detailed system of tabulation as the means of reaching the best results. It is by the comparison of coal with coal, boiler with boiler, engine with engine, type with type, appliance with appliance, that these results may be obtained. Those who have had experience in collecting data of the kind required will comprehend at once the difficulties encountered in the process of getting information which shall fully cover the many important points in the case.

Not only should there be no objection on the part of the companies, their managers or superintendents, to giving information that is reliable in character, accurate in detail, and comprehensive in scope, but there ought to be most cheerful acquiescence.

We are organized for purposes of free interchange of thought and experience, with a view to mutual advancement and benefit. In these tables each one is liable to discover information upon some important point which should be of great value to him. Naturally the broad ground of justice, fairness and liberality of feeling is expected to be our starting point.

If I have succeeded in interesting the gentlemen in the importance of "collecting data for these standards," I will feel justified in having consumed the time of the convention. If carried out we will reap the benefit in having on record the facts and figures which have been so often called for; and the answer to the three great questions, What is your equipment? How many lights do you furnish? How much coal do you burn?

The PRESIDENT: The paper is now open for general discussion in the Convention. Perhaps it would be as well for Mr. Williams, who is to speak on the triple expansion engine, to follow with his paper. We can take them up and discuss them at once.

Mr. WILLIAMS: I had hoped to get enough accurate data concerning the performance of triple engines to bring before you and to make the subject the basis of a paper, but circumstances have been such that the engine I attempted experimenting on has been so situated that I could not get it rigged up for making the tests, and therefore I cannot give you any accurate data in regard to high speed triple expansion engines for central station work. The main points to be considered in the matter are, however, first, the matter of regulation. Perhaps that is of the highest importance, and the matter that is in most question by engineers, as to whether there will be a momentary variation in the speed of the triple engines when the load is suddenly increased or decreased, that would not occur in single cylinder engine practice. Now that matter depends mainly on the weight of wheel and the intermediate spaces or clearances, and will be modified more or less by the accuracy or quickness of the governor; and as to whether this can be done or not, I will say yes, it can be done. The weight of wheel can be made sufficient, the clearances can be made sufficiently small, and the governor can be made sufficiently quick, and it is done so that the engine will not vary materially under sudden changes of load. Of course, the smaller the clearances, the heavier the wheel and the quicker the governor the less will be the momentary variation. As to the matter of cost, taking the entire plant considered as a whole, boilers, engines and all, the triple will cost, I presume, approximately 20 per cent. more than the compound. The economy of triple is unquestionably considerably in excess of compound on the evidences so f taken from marine practice, for example, about 20 per cent. in the compound. It is a fact that compound engines, compound plants under ordinary circumstances where coal is say at an average price of $3 per ton, will consume their entire first cost in about five years' work in coal bills. Assuming that the triple will save 20 per cent. over the compound, the triple would save the excess of cost over the compound in the first year's service.

There is another matter to be considered, namely, the reliability of the machine, the smoothness of action. The triple has advantages over the compound in that respect, theoretically, which, as far as we know of it so far, practice has sustained. It appears, as far as the evidence goes, and as far as we know of their action, that the triple engines are a much easier engine to care for than the compound. The compound is much easier to care for, ordinarily, than the single for reasons which are accounted for in theory and I think the practice will sustain the theory.

I ask your pardon for not having a paper prepared, but I could not get the exact facts to bring before you, therefore it has been quite impossible for me to do so.

Mr. GARRATT: I, unfortunately, did not hear the report of the Committee on Data, and it occurred to me that possibly the compilation and the very figures that were suggested in Mr. Swetland's paper might be a part of the plan of the committee. If not, I would suggest, and when I am informed, move that a small committee, say a committee of three, be appointed by the chair to report at the next convention on the actual cost of producing power in central station practice in this country, giving actual data of operation, that is, the nature of fuel, the nature of steam equipment and the nature of engine equipment. If that, however, is going to fall within the province of this other committee, I will not make that motion. I am asking for information.

The PRESIDENT: The general plan which was originally adopted for the Committee on Data was intended to comprehend that subject, and you might make the motion to have it referred to the Committee on Data, with instruction to report. It was intended to comprehend subjects generally of that character, and if they are pursuing a particular line of work, there is no reason why they should not take this up and go ahead and report under instruction. The fact is, that the Committee on Data has not reported.

Mr. GARRATT: Oh, I thought it had. Then, I will move you, sir, that the subject of Mr. Swetland's paper be referred to the Committee on Data with the suggestion if they are not going to make a specific report upon that subject that either a sub-committee or a new committee be appointed to report at the next Convention on the point touched upon in Mr. Swetland's paper.

The motion was carried.

The PRESIDENT: Mr. Huntley is down for a paper the title of which is, How can the National Electric Light Association best serve the interest of Central Stations? Mr. Huntley has evidently not determined that yet, as he is not here.

As Mr. Huntley does not seem to materialize, I think we will call for the report of the Committee on the Revision of the Constitution, M. J. Francisco, Chairman. I will state in that connection that the committee will move the adoption of the report and it will then stand over until 11 o'clock to-morrow. In the mean time copies of that can be distributed by the page of the Convention.

The report was read as follows:

Mr. FRANCISCO: In behalf of the committee I offer the following resolution:

Resolved, That the report of the committee on the revision of the constitution be accepted and adopted, the new constitution to take effect Jan. 1, 1891.

Mr. DUNCAN: Mr. Chairman, I move that the report of the committee be received, and the order of business be fixed for its consideration to-morrow morning, and that we take it up for consideration seriatim, and that immediately thereafter follow the resolution as reported by the chairman of the committee.

The PRESIDENT: Will you make that at 11 o'clock to-morrow morning?

Mr. DUNCAN: I left that for your consideration, or that of the Executive Committee. I accept the suggestion of the Chair.

The PRESIDENT: The stenographer will insert 11 o'clock to-morrow unless there is some objection.

The motion was duly seconded and carried. Adjourned.

FIFTH SESSION.

The Association was called to order at 11 A. M., and Mr. Barrett then arose to institute some inquiries concerning the paper read by Mr. Francisco on "Municipal Lighting." As the consideration of a proposed revision of the constitution had been set apart as a special order for this hour, Mr. Barrett was ruled out of order and his questions deferred until the special business had been transacted. That subject was then laid before the house, and the proceedings on it were opened by Dr. Mason.

Dr. MASON: Mr. President, have we now before us the proposed report of the committee on the constitution?

The PRESIDENT: We have.

Dr. MASON: Is that to be read, or is its consideration now in order. The motion, if I remember rightly, was that it should be taken up this time article by article.

The PRESIDENT: It was presented last night, and read when presented. Copies of it have been distributed to all who have applied, and I do not think it is necessary to proceed to read it again. I think the gentlemen have acquainted themselves with it. That was the object in giving them an opportunity to become acquainted with it beyond simply by hearing it read quickly.

Dr. MASON: Will you kindly permit me to give notice that when we shall come to the consideration of Article III. I have an amendment which I wish to offer.

Judge ARMSTRONG: I believe that the resolution offered by Mr. Duncan was that the constitution be taken up seriatim this morning. By that I suppose it is understood that the Secretary need not read the words of each article, but that he need merely read the title of the article, as we have the constitution in our hands, and can consider the articles as read. That will save time, as you have suggested.

The PRESIDENT: The Secretary will read the first article.

The SECRETARY (reading): "Article I.—Name. This Association shall be entitled the National Electric Light Association."

Mr. DECAMP: I move its adoption.

Judge ARMSTRONG: May I suggest that if there is no objection stated to the adoption of the articles that they be considered as adopted. That will save the necessity of taking a vote each time.

The PRESIDENT: If I hear no objection we will consider that the article is adopted. There is no objection. It is adopted. The Secretary will read the second article.

The SECRETARY (reading): "Article II.—Object. The object of this Association shall be to foster and protect the interests of those engaged in the commercial production of electricity, for conversion into light, heat or power."

The PRESIDENT: Unless I hear some objection I shall regard this article as adopted. It is adopted.

The SECRETARY (reading): Article III.—Membership. Section I: Members shall be divided into three classes—Active, Associate and Honorary. Active members only shall be entitled to vote and take part in the deliberations of the convention, and shall be corporations or individuals engaged in the business of producing and supplying electricity for light, heat or power, for commercial or public use."

Mr. ALEXANDER: Will you consider that section by section?

The PRESIDENT: It is to be considered section by section, article by article.

Dr. MASON: I desire to offer an amendment to this article, and then I wish to move to strike out entirely Article 3, provided my amendment shall obtain. If my motion, after I shall have presented it, is seconded, then I shall have a few remarks that I wish to make upon the matter. I move you, sir, that in line 4 the word "associate" be stricken out, and that the words "and take part in the deliberations of the convention" be also stricken out; and that the word "three" in line four be changed to "two." This would make the section read: "Members shall be divided into two classes—active and honorary. Active members only shall be entitled to vote, and shall be corporations or individuals engaged in the business of producing and supplying electricity for light, heat or power, for commercial or public use." If my motion is seconded, I wish to make a remark upon that amendment.

The PRESIDENT: I understand that you offer that as an amendment?

Dr. MASON: I do, sir. I move that as an amendment.

Mr. SEELY: I second it.

The PRESIDENT: The motion has been made and seconded. I presume the gentlemen understand the amendment as offered by Dr. Mason: and he will now proceed with his remarks.

Dr. MASON: Now, Mr. President, I wish to say that I had the honor to be a member of the Committee on the Constitution, whose report is now before you. The proposed constitution, as it is printed and in your hands, was brought before this committee: and I was compelled in the committee to say that I could not sign the report, and I never have signed it. I stated to the committee that it seemed to me that this was—I will not say a deliberate and intentional—but that it was nevertheless a real insult to every associate member; that it asked him to take a position here which it seemed to me no man could take and maintain his self-respect: that it asked him to become a so-called associate member of this body, but with absolutely no rights or privileges excepting those of sitting here during the open door sessions, but not when executive business was being considered. I do not voice any other man in what I have said or am saying; but for one I wish to say that I do not see how any gentleman can maintain his self-respect and occupy such a position as that in any body. The intent of this is undoubtedly to shut associate members entirely out of all contact with the Association. Now, gentlemen, if I were purely and simply engaged in the business of producing and supplying electricity for light, heat or power for commercial or public use, I think it is quite probable that I should desire to be a member of an association composed only of such men, or at least only where such men have any voice in its proceedings. Things have been developed which seemed to render it necessary for the self protection of the class of gentlemen referred to here that they should have just such a closed door association. I am not one of those, however. I happen here to represent a central station for the time being, in which central station I am not an officer. I do not intend ever to be an officer. I may be in some other station, but it does not seem to me possible that I could ever, while engaged in business as I am, permit myself to be a member of the National Electric Light Association under the conditions proposed in this revised constitution or in the one which may exist if my amendment obtains. So much for the personal part. Now it is a fact that certain members—my own impression is that a large majority of the active members—of the National Electric Light Association feel that it is necessary for them to be by themselves; they feel that the associate membership, as a whole, is a disturbing element, a dangerous element. I recognize the fact that originally they received associate members into it with certain privileges. They have since curtailed those privileges. They now propose to curtail them yet more. I say they have a right to. I do not dispute it for an instant. Whether they have the right or not I would accord it. I would vote that they might have it; but I would not sit in any such body, occupying the relation I do to business interests. Therefore I make this motion in order that if anything like this constitution is to be passed by this body and accepted as its governing plan, we shall not be found in the position in which this would leave us. It is without any spirit of anger, without any rancor, without the slightest feeling that I offer this amendment. I am aware that some gentlemen wish to so turn this about as to leave it about as it is now—that associate members may have certain privileges, but not that of voting. I believe that the National Electric Light Association in its active membership has its rights—they alone will vote upon this constitution. I speak to them now when I say this: You do offer us an insult if you pass this article and adopt this constitution as it reads here, and for one I do not want it. You do what you have a right to do if you strike these words out and leave us entirely in the cold. I believe it would have been more courageous of you, more manly, to put it squarely to us in that way. I say either leave us with all the privileges we have under the present constitution or strike those words out, and leave us out with the words. (Applause.)

Mr. Alexander then rose and, after some discussion of the proposed change, offered a substitute motion which was not acceptable to Dr. Mason, who said:

Mr. President, I should be glad to know the object of the substitution. I do not see it. I see no reason why I should accept that. It is not an amendment that really modifies my motion. It is an amendment that entirely does away with the intent of my motion. I can accept it only as far as I know for what reason it was offered.

Mr. ALEXANDER: I offer this, as I said before, not to embarrass future action here. I will give notice now that I will offer an amendment to Section 3 of Article III., to add the words, "who may take part in the discussion of papers read before this Association," so that Section 3 will read: "Associate members shall be electricians, electrical or mechanical engineers, manufacturers and individuals who are otherwise directly or indirectly interested in advancing the use of electricity, and shall have the right of attending all the meetings of the Association except executive sessions, and to take part in the discussion of papers read before the meeting."

Mr. MASON: I will explain my position exactly. I want this Association in its active membership, who alone can vote on this matter, to decide this question. Do they wish —is it their judgment that their interests require that all associate membership shall be wiped out? They will have an opportunity to vote upon my motion. If they have the opportunity they will say unequivocally that they wish to wipe it out or that they do not wish to wipe it out. If they do not, they may either table my resolution or vote against it, and then they can go on and make any amendments they please. If the majority of the active members of the Association vote in favor of my resolution they thereby say "We do not want any associate membership." If they shall have said they do not want associate membership, then I think that the gentleman's proposition may come in order.

Mr. ALEXANDER: With the consent of the meeting then, I will withdraw my amendment, to be offered after the vote is taken on the amendment of Dr. Mason.

Mr. DUNCAN: I would just simply say, if you will permit me to say one word to the gentleman, that as the vital question is now brought before us by the motion of

Dr. Mason that it would neither be proper nor right to force a motion of that kind to lay on the table and cut off debate upon a very vital part of the whole subject matter before us. I would appeal to his generosity to let everybody here have a word to say on that point, because that seems to be the vital point, and then, after a proper time for discussion, if you want to lay it on the table, let us lay it there. But do not let us right in the incipiency cut off debate upon the main question which is brought up by that amendment.

Mr. SEELY: I would like to state my object in placing my motion before the Convention: Dr. Mason stated here that he would like to draw out the sentiment of the members by asking whether they desired the associates to take part in the debates. As the article now reads it gives them the privilege of the floor. I am in favor of the article being carried by the Association as originally drawn. Therefore I moved that the original article be read again, and if seen fit by the Association, approved. I now withdraw my motion.

Mr. T. CARPENTER SMITH: As I understand the case now, Dr. Mason has presented his amendment with the idea of bringing out the feeling of the active members of the Association with regard to this change in the constitution. I am one of the active members, and always have been a central station man, and I speak with more freedom. The first words I ever spoke in a convention of this Association were to urge one of the points in this paper on the constitution that the associate members should not have a vote but should be entitled to all the privileges of the floor. At that time the feeling was very strongly against such a change being made, and I was called down very shortly by the then President of the Association, but as time has gone on things have changed, and we now have the membership practically divided in that way. As a central station man I think that we most certainly do want the associate members in. The associate members are a very valuable part of this Association; and I think nothing brings that more strongly before us than the fact that in the first place the Association is founded for the benefit of central station men, that they may get information and help from it. Now my experience has been that where you get a body of men all working in the same business every one of those men will have a different way of doing that business, and as a rule can see no other, and even with the best intentions; his mind gets into a certain groove, and the little business secrets that he has may be devices of his own, and he does not care always to give them away. Not only that, but in the present state of the industry in this country the central station is absolutely dependent upon the associate member in the manufacture. There is not, I believe, a single central station in this country that manufactures its own apparatus, its own wires, or its own supplies, except in such minor details as brushes and things of that kind, and there again he is dependent upon the copper men. The time may come when central stations may as they are doing now, some of them in Europe, make their own machinery; but I think that time is pretty far off in this country. Now, when a central station man wishes to get information about the merits or demerits of an apparatus which he wishes to purchase, or supplies which he wishes to purchase, if he goes to another central station man to get his information the chances are that he will get an opinion and that will be all; the materials supplied by that man may not be used under the proper conditions and the conditions intended by the manufacturer, and consequently it is not tried under fair conditions. But if we have associate members with us at these meetings and a paper is presented by one of those associate members, or if they get up and make statements, and if those statements are not correct there is sure to be some other associate member in the same line of business who will point out the defects, and the question is discussed; and the best time for central station men to get the best knowledge is when the associate members are quarreling among themselves. (Laughter.) Now if you shut off the associate members from discussion on the floor you lose the benefit of all that. Not only that, but the minute you strike out the associate members from any representation in the Convention they will do, I believe, as I would do—get right out and not come here. Now I have stated more than once that the associate members and supply men will come to the Convention any how. Men who have goods to sell will come here. They will continue to do it but it will be done in a very different way from what it was before. At present I think the manufacturers are some of the best men in the Convention, men who are not simply salesmen but who discuss things intelligently and who can meet the central station man on his own ground and make an effort to provide material and devices that shall meet his wants; but if the supply men are only to have an opportunity to sell their goods they will send around a salesman with a big sample case, and that is the end of it.

Another point: We had a paper presented here yesterday by Mr. Lufkin. As a central station man I do not hesitate to say that I do not think there is one central station man in ten in this country who can discuss that question; it is not in their line to discuss the efficiency of motors and things of that kind as regards their manufacture; it is only as regards their use; and when we get papers like that from the associate members it shows the value of the associate members. If you look through the past proceedings of the Association you will find that a great many of those papers have come from those men. I hope Dr. Mason's amendment will be voted down, because I believe there is an amendment going to be offered which will cover that ground exactly; that is, to leave the associate members as members of the Convention, with the right to discuss all papers on the floor, and simply leaving them in the same condition as they were before; but giving to active members only the right to vote and the right to be in executive session and to direct the policy of the Association, which is after all intended for central station men. But I do not wish to see central station men cut off from what I have always considered to be the most valuable source of information which they possess. (Applause.)

Mr. ALEXANDER: Mr. President, this does not cover the question that Dr. Mason raises, and that is whether you want any associate members at all. That is the question that he raises and that is the question that he wishes to have a vote on, and I think by voting on that question soon we can soon decide it.

The PRESIDENT: Dr. Mason, will you read your resolution again and the Chair will order a roll call.

Dr. MASON: My motion was that in Section I. of Article III., in line 4, the word "three" be changed to the word "two;" the word "associate" be stricken out, and that the interpolation in line 5, that is, the part that is written with a pen, be also stricken out.

The PRESIDENT: Will you kindly now read the section as it will read if adopted?

Dr. MASON: "Members shall be divided into two classes—active and honorary. Active members only shall be entitled to vote, and shall be corporations or individuals engaged in the business of producing and supplying electricity for light, heat or power, for commercial or public use."

The PRESIDENT: The Secretary will proceed to call the roll.

(The Secretary commenced to call the roll, and called the name of the Rutland Electric Light Company, and Mr. Francisco voted "No.")

Dr. MASON: May I rise to a point of privilege? I wish the Chair to state the intent of an aye and of a no vote; and that voting aye means to pass my amendment, and a vote no, not to. I know that some do not understand it.

The PRESIDENT: The Chair will offer the explanation. If you vote aye you vote to have this Association composed of two classes of members only, honorary and active. If you vote no you vote to have it composed of three classes of members, honorary and active and associate. Now we will begin the roll again.

Secretary FOOTE: I will commence the roll call once more. Rutland Electric Light Company, Rutland, Vt.

Mr. FRANCISCO: Mr. President, perhaps it will be well to say that I am the chairman of this committee and put in this report. I vote no, as I made my report. Of course I cannot go back on my own report, no matter what I thought otherwise.

(The Secretary then completed the calling of the roll.)

The PRESIDENT: I think it is perfectly fair to say in regard to Mr. Barrett of Chicago, whose name is there under conditions under which the vote was challenged before—I think under the same conditions under which Mr. Weeks' and another gentleman's vote was challenged yesterday—and I think it should be passed on by the Convention or should be withdrawn, because it is there on the roll, and I think it should be passed upon just the same as those two yesterday.

Mr. WEEKS: Mr. President, if it is in order, I would say that the Committee on Credentials would like instruction in regard to this case.

Secretary FOOTE: The entry on the roll is "Electric Lighting, of Chicago, Ill., John P. Barrett, representative."

Mr. ARMSTRONG: Do I understand, Mr. President, that you have ordered that called by the Secretary?

The PRESIDENT: I ordered that called.

Mr. BARRETT (voting): No.

Judge ARMSTRONG: I challenge that vote. I desire to say that I do it on the ground of the challenge that was made yesterday to Mr. Week's individual vote. I believe my challenge to be wrong. I believe that challenge was wrong. If Mr. Barrett is entitled to vote, Mr. Weeks is entitled to vote. I believed Mr. Weeks was entitled to vote; I therefore believed that Mr. Barrett is entitled to vote, and that if we refused one we must refuse both.

Mr. WEEKS: The city of Chicago corporation is not a member of this Association. This membership is taken out by Professor Barrett in his own name in the capacity of superintendent of lighting in that city. It is exactly a parallel case to my own, and very nearly a parallel case to that of Mr. Hegeman, whose vote was also challenged on roll call yesterday. We have all three paid our $20.

Judge ARMSTRONG: If you will permit it as a privileged question to gain the sense of this Association, I move that the vote of Mr. Barrett be permitted; and, of course, that, by the ruling of the Chair, will permit the vote of Mr. Weeks.

Mr. SEELY: I second that motion.

The question was put and voted on.

The PRESIDENT: The ayes appear to have it.

SEVERAL MEMBERS: Division.

The vote being taken, the President announced that the motion was carried by a vote of 13 to 3.

The PRESIDENT: The Secretary will announce the vote.

Secretary FOOTE: Forty-one votes have been cast, all of them No.

The PRESIDENT: One gentleman has changed his vote, which he had a right to do before the announcement of it. It is simply a unanimous vote.

Mr. ALEXANDER: Now, Mr. President, I am about to renew my amendment to Section I. Article III.; but before I do it I would ask the President, to facilitate matters, if he would call instead of a roll-call a rising vote, with the privilege of challenging, whether they are active members or not; that is, a rising vote of active members on each section, instead of a roll-call, so as to facilitate business. I renew the amendment that I offered before, that the word "only" in line 5, Section I. Article III. be stricken out.

Dr. MASON: Mr. President, I rise to second the motion, and having seconded it I desire to say that this has been one of the most interesting and amusing and decidedly convulsing occasions in which I ever had a part. I was taught when I was a boy to believe what I have since ceased to believe, but to-day I am completely changed again; I had been taught to believe in instantaneous conversion, and I have seen illustrations of it to-day beyond anything I ever conceived of or heard of in theological seminaries; or else it is eating crow; I don't know which, and I don't care; but I declare to you, sir, that the majority of the men who voted no all told me that they wanted us out; and now I hope they will eat crow by saying that they will put it through in just the line we want it; and I am going to vote for it.

Judge ARMSTRONG: Mr. President, I believe the company of which I have the honor to be president was the only one that voted aye, and my associate cast that vote. I was a member of this committee that framed this constitution. As it stands here I am in favor of it. The challenge of Dr. Mason was, "Do you want us or don't you? If you want us we want more than the committee gives. I speak for them." Now we may want you and want to give no more than the committee proposes to give here. I cannot vote for this other amendment that is proposed, and I don't propose to eat crow. I don't enjoy it, and I don't propose to take it. Now I don't know anything about the difficulties that the Convention has had with associate members. There has never been any difficulty; things have been as pleasant as could be. I have had come to me since I have been here suggestions, not from people who are hurt, but who are active members themselves, that have convinced me very thoroughly and very entirely that business enterprise and business methods should not come into an association that is professedly for the purpose of educating people who are in a common line. (Applause.) It is said that supply men and material men desire to have some curious, peculiar connection with the Association, and to be called associate members. Now, if I were a supply man I would say "Yes, I am willing to give you the $20." I would join with Dr. Mason, however, in saying, "I don't care to be a member of an association and talk in the association and take part in the deliberations and make motions that I cannot sustain, that I am not permitted to sustain." And, therefore, on that ground I should have been perfectly willing to have my vote stand in favor of Dr. Mason's amendment, cutting that out of the constitution. But, Mr. President and gentlemen, be it understood as far as my voice can reach, that not one member of this committee, not one member of this Convention, not one stockholder in one company represented in this Association, would do right to hurt the feelings, to ride over the prejudices, to interfere with the enterprise of any one of the noble manufacturing companies represented here. They are grand enterprises. We wish them Godspeed' because by their competition, because by their questions' we as central station men, we as stockholders, we as persons interested in these corporations, expect to gain advantage, to gain profit. But, Mr. President, if this Association is permitted to become, or suspected of becoming, in any manner a vehicle to advertise any person's patent, any person's scheme, or any corporation's desire to do business, the sooner you wipe out the Association the better. It does not perform the function for which it was intended. Therefore, Mr. President, while I am perfectly content to have all the supply men in the United States who are producing in any manner, and who are directly or indirectly advancing the use of electricity, come within our doors by right, sit in our deliberations by right, and be called upon as associate members to speak, I am not willing, Mr. President, that they should have the power to direct the business of the Association by making motions and doing such business. Put me in a convention or anywhere else and give me no right to vote but give me the right to make motions, and while I cannot accomplish anything I can do a good deal of destruction. Now Mr. President, I believe that this constitution as it stands will give, notwithstanding what my friend Dr. Mason says, after such an explanation—and upon that explanation I think every member of this Convention will be willing to rest, who believes with me—after that I cannot see why every supply man, every associate member now could not accept the constitution as it stands. If he cannot, as for me I must say that I cannot give him more. I believe that he ought to accept, and if he is willing to be a member of the Association and not have the right to vote he certainly ought to be willing to take what this constitution gives.

Mr. ALEXANDER: Mr. President, I take it that the remarks of Mr. Armstrong on the question now before the assembly are out of place. We simply want to strike out a superfluous word, not to embarrass future action. When it comes to Section 3, I will offer the amendment which I have foreshadowed—unfortunately foreshadowed—and then Mr. Armstrong's remarks will be fitting; but the present amendment only proposes to strike out the word without which the meaning of that article is not changed in the least.

Judge ARMSTRONG: That is very necessary; that covers the other.

The PRESIDENT: Mr. Alexander, will you read to the Convention, as you have prepared it there—it is not convenient for the Secretary to read it—the section as it will be if your amendment is adopted?

Mr. ALEXANDER: The section will read as follows:

"Members shall be divided into three classes—active, associate and honorary. Active members shall be entitled to vote and take part in the deliberations of the convention, and shall be corporations or individuals engaged in the business of producing and supplying electricity for light, heat or power, for commercial or public use."

There is not a word said there about what they should not do or about what they are entitled to do.

Judge ARMSTRONG: Will Mr. Alexander permit me to interrupt him? If the amendment that he proposes is adopted there will be a decided conflict. I addressed my remarks because he proposed to change this section, so as to meet a proposed amendment. I have not anything to say on his amendment after he gets down there; I have had all my say, and it was perfectly proper. I submit, for me to say it; and I desire to ask him now if his purpose in striking out the word "only" is not to permit associate members to take part in the deliberations, under certain conditions?

Mr. ALEXANDER: Under certain conditions, yes; in the deliberations of the Convention as far as the discussion of papers in open session.

A sharp discussion then followed on Mr. Alexander's proposed substitute motion, Mr. Francisco, chairman of the Committee on Revision of Constitution, holding that it left the matter more ambiguous than at present.

Mr. Alexander then offered an amendment, and a protracted discussion followed until, finally, the proposition was reduced to definite terms, and the Association proceeded to hear it read.

The PRESIDENT: The Secretary will now read the amendment as proposed finally by Mr. Alexander to the Convention.

Secretary FOOTE: I will read it first for Mr. Alexander to see if I read it as he wants it put and then I will read it for action. Mr. Alexander, I understand your motion to be this, that Section I. be so changed from that reported by the committee that it shall read:

"Section 1. Members shall be divided into three classes—active, associate and honorary. Active members only shall be entitled to vote, and shall be corporations or individuals engaged in the business of producing and supplying electricity for light, heat or power for commercial or public use."

Is that correct?

Mr. ALEXANDER: That is correct.

Secretary FOOTE: Gentlemen, I will read the amendment for your action. (The Secretary again read the proposed amendment.)

Mr. GARRATT: Mr. President, I have an amendment to that amendment which I wish to offer, to cover the point which was raised by Judge Armstrong in regard to these individual memberships. I am of the deliberate opinion that there has not been a ruling of this body at this Convention so unfortunate as that particular vote. As you know, this Association when it was started was composed of memberships which were corporations. At the New York convention that was changed so that all the memberships became individuals, and the entire roll had to be changed from cor-

porate memberships to individual members. At Niagara Falls that was changed back so that they might be either corporations or individuals, and all, with one or two exceptions—there are only three here at this convention—claim active membership under an individual name. Personally, that I believe to be a very unfortunate condition of things. I would therefore offer as an amendment to the amendment of Mr. Alexander, that these words be added to his amendment: "No individual actively associated with a corporation holding an active membership shall become an active member."

The PRESIDENT: The question is now on the amendment offered by Mr. Alexander.

The amendment was adopted.

The next consecutive section of the constitution was then taken in hand, and a very much protracted discussion followed, particularly composed of efforts to bring several different amendments to the section in question. Finally, matters were brought down to a definite basis, and the section was read by the Secretary.

Mr. WHIPPLE: I gave notice of an amendment to that section. I rose to amend that, but they called me down. I want to amend Section II. that is, or Section III. that was. Am I in order?

The PRESIDENT: Yes.

Mr. WHIPPLE: Then I move that on line 14, after the word "and," which is the first word in that line, that we insert the words "corporations and," so that the section will read:

"Section II. Associate members shall be electricians, electrical or mechanical engineers, manufacturers and corporations and individuals who are otherwise directly or indirectly interested in advancing the use of electricity, and shall have the right of attending all meetings of the association except executive sessions."

Judge ARMSTRONG: I think that that is already covered by the words that the committee have reported, but we will accept that amendment. As I understand Mr. Whipple, he desires that corporations that are engaged in manufacturing shall also have the privilege of becoming associate members

A sharp debate followed this proposition, and several more amendments were proposed and abandoned in the course of the discussion. Finally, after a large amount of time had been consumed and very little had been accomplished, a proposition was advanced by Mr. Brown, involving some considerable changes.

Mr. BROWN: I propose to amend Section II. as it is now, as I understand it. I move to amend it by striking it out. And, in explanation of this amendment. I would read, with the permission of the Chair, the other amendment, which explains this amendment that I now offer. The gist of the change is that "Members shall be divided into two classes, active and honorary. Active members only shall be entitled to vote and take part in the deliberations of the convention; and shall be corporations or individuals engaged in the business of producing and supplying electricity for light, heat or power for commercial or public use; and electricians, electrical or mechanical engineers, manufacturers and individuals who are otherwise directly or indirectly interested in advancing the use of electricity." Later on, in defining the duty of the President and of the Vice-Presidents, the constitution would be amended to read:

"The president and vice-presidents shall be elected to serve one year from the first of the month following the date of their election, and shall be active members. The president shall act as chairman of the executive committee during his term of office. He shall not be eligible to re-election for two years after his first term has expired. The president and vice-presidents shall be individuals or officers of corporations actively engaged in the business of producing and supplying electricity for light, heat and power for commercial or public use."

And a new article as follows:

"Article XIII.—Section I. No vote, resolution or declaration of the association shall stand, or form part of the record, until it has received the signature of the president, who is vested with the power of veto.

"Section II. Any vote may be called up for consideration at the convention succeeding that at which the vetoed measure was introduced, by a two-thirds vote of the members present, and said measure shall only become a valid act of the association, without the signature of the president, upon then and there receiving an absolute two thirds vote of the whole membership of the association."

I move as an amendment of Section II. of Article III. that it be stricken out.

Mr. ALEXANDER: There is a section, as prepared by the gentleman, preceding the sections read, in which it is definitely stated that the associate and active members (and I have been told so by the gentleman himself) shall have the right to vote, and that the President shall have the right to a veto. Then, if the Association should have more associate members, and they should sustain the President, they would, through the President, control the Association. Therefore, and for the same reasons stated before, I move that this also be laid upon the table.

After further discussion, this amendment concerning the conferring of the veto power was laid upon the table, and the following final form of the section which had produced so much debate was adopted:

"Section II.—Associate members shall be electricians, electrical or mechanical engineers, manufacturers, corporations and individuals who are otherwise directly or indirectly interested in advancing the use of electricity, and shall have the right of attending all meetings of the Association, except executive sessions, and shall have the right to discuss papers before the conventions."

On motion of Mr. Wilmerding, Section III., as reported by the committee, was adopted, as follows:

"Section III.—In the case of a corporation the membership may stand in the name of the company, and such company shall have the right to be represented at any meeting of the Association by any of its officers or directors, or by its regularly employed managers or superintendent."

The PRESIDENT: Section IV. is next in order.

Mr. ARMSTRONG: I move the adoption of Section IV.

Mr. GARRATT: I now offer the amendment that I offered to Section II., and I wish again to impress upon the delegates present the difficulty and complexity which has arisen from having both corporations and individuals as active members of the Association. I see no reason why electricians cannot become active members, or corporations; but to have corporations members of the Association, and then have one of its executive officers come here and cast his own individual vote, or have half a dozen officers come in and each one cast an individual vote, is, as it seems to me, turning aside from the original meaning of this constitution. I therefore offer the amendment to Section IV. which I offered to Section II. in the report of the committee, by adding the words:

"No individual actively associated with a corporation which holds active membership shall become an active member."

Mr. FRANCISCO: Will you let me explain with regard to that section?

Mr. WHIPPLE: I would like to ask Mr. Garratt, who would be actively associated? would a stockholder be?

Mr. GARRATT: As to who would be considered actively associated with a corporation, I should say one of its officers.

The PRESIDENT: There might be a little ambiguity there which it would be well to avoid.

Mr. GARRATT: I suppose that the Chairman of the Committee on Credentials would have to rule on each individual case.

The PRESIDENT: It is better to settle those things now than leave any questions to be settled by the committee. It would be well now to anticipate and remove any ambiguity of that kind.

Mr. GARRATT: It has been suggested to me that any man receiving a salary from a corporation shall be considered an active member of the corporation.

Judge ARMSTRONG: Will not this accomplish what Mr. Garratt wants?

"No person holding individual membership shall represent a corporation."

Mr. GARRATT: That will answer quite as well.

Judge ARMSTRONG: I might, as president of my corporation, not want to represent the corporation at all, but still be a member of the corporation, and some other officer might vote.

Mr. GARRATT: No; I will take that back. I think that it will not cover it. I do not want individuals members in the association. I want them to vote by corporations.

Mr. FRANCISCO: Suppose that I owned a plant individually; then, under Mr. Garratt's ruling, I would be ruled out entirely?

Mr. GARRATT: No; you would not be.

Mr. FRANCISCO: Then why should I be ruled out if I own a station individually and am also a member of a corporation?

Mr. ALEXANDER: I think that the word "one" after "any" will settle that, so that it shall read "any one of its officers and directors."

Mr. DECAMP: But that is not what Mr. Garratt wants to cover. He wants to cover just exactly such a case as that of Mr. Weeks. Mr. Weeks claims the right, by paying a due, which is his only qualification under the present constitution, to be an active member, because he is personally actively engaged with a company which he happens to also represent as their officer here in the association. Now, I think that it is very proper, but I think the wording of this amendment would be better as suggested.

Mr. GARRATT: Perhaps I can make it plainer by referring to that in line 5: "Corporations or individuals engaged in the business of producing and supplying electricity for light, heat or power for commercial or public use." I would have that read, "individuals not engaged in, but owning plants." A man owning a plant ought to have a right to vote, even if he happens to be an officer of a corporation which is likewise a member.

Mr. DECAMP: Certainly he ought to have the right to vote.

Mr. GARRATT: Mr. Weeks does not own a plant and I do not own a plant myself, but if I had a plant I ought to have another vote; not owning any plant I ought to have but one vote. I would like to see my amendment entertained.

The PRESIDENT: The Secretary will read the proposed amendment which Mr. Garratt has now submitted.

Secretary FOOTE: Mr. Garratt's motion is that the following language be added to Section IV., which is Section II. as printed:

"No individual actively associated with a corporation holding an active membership shall become an active member."

May I put one word in there so that it shall read "may become individually an active member."

Mr. ARMSTRONG: Let it be clearly understood that if we adopt this amendment now proposed it will prevent any individual owning a plant supplying for commercial or public use electricity from becoming a member of this Association. Then, if we do that, if he may happen to be interested in another corporation, and a member here, you do two things: you keep out the individuals, or you prevent all the interests engaged in the electric lighting business from being represented. Now, if I am a member of a corporation—or suppose that I was one of the directors of your corporation, and down at a little hamlet near your place, not liking the way you did business, I should start an electric light plant there to supply the place; and I want to come here and become a member of this Association; I want to get the advantage and benefit of such membership; I want to have a voice in your proceedings; I want to vote and speak on matters which are here considered. I cannot do it, because forsooth I happen to be a member of a corporation here represented. By this amendment I may be kept out either on one side or the other, and therefore I do not think that this amendment would be a fair thing.

Mr. GARRATT: I appreciate the difficulty that Judge Armstrong suggests, and I think it may be met by adding these words:

"Unless he shall own and operate a central station on his own account."

That meets exactly your requirement, does it not?

Judge ARMSTRONG: It meets that point, but it does not meet my whole objection.

Mr. GARRATT: What point does it meet?

Judge ARMSTRONG: It does not meet the case of Mr. Weeks or of Mr. Barrett.

Mr. GARRATT: I have seen that difficulty in this Association for a number of years; and I think we cannot meet it.

Mr. DE CAMP: How does that amendment now stand, as suggested?

The PRESIDENT: The Secretary will read it as it now stands.

Secretary FOOTE: As I understand Mr. Garrett, his amendment is this—that after Section IV. (which is Section II. as printed), the following is to be added:

"No individual actively associated with a corporation holding active membership shall become an active member individually unless he shall own and operate a plant individually."

Mr. GARRATT: That is my amendment.

The PRESIDENT: The question is on the adoption of the amendment. Those in favor of its adoption will manifest it by saying aye; those opposed, no; the noes appear to have it.

Mr. GARRATT: I call for a division on that.

A brief discussion then followed as to the proper technical meaning of "Central Station," in order that private plants and the plants intended for the purposes of the Association should be clearly distinguished from one another.

Secretary FOOTE: May that read, "Central station plant individually?"

Mr. GARRETT: Yes.

The PRESIDENT: The chair will order a division. Those in favor of the adoption of this amendment will manifest it by rising; those opposed, in the same way. There are four votes for and five against it. It is lost.

Mr. WHIPPLE: I have an amendment to offer. On line 8 I move that in place of the word "may" be substituted the word "shall," and that in line 10 after the word "superintendent" the words be inserted, "properly accredited representative," thus making the section read as follows:

"SECTON III. In the case of a corporation the membership shall stand in the name of the company, and such company shall have the right to be represented at any meeting of the association by any of its officers or directors, or by its regularly employed manager or superintendent, or by a properly accredited representative."

Judge ARMSTRONG: If Mr. Whipple will divide the amendments I will accept the first on behalf of the committee, but not the second. My reason for not accepting the second is this—and I think that he will see the force of the point: That exactly this one thing as suggested by Dr. Mason and by other speakers here can be accomplished by having plants send representatives who are engaged in other business and not actively engaged in central station business. What we want to get here is not to have the companies send their proxies, but what we want is the men who are actively interested in central station business.

Mr. WHIPPLE: I agree with the gentleman, with this exception, that out of 1,600 central stations in this country we have a very small percentage of membership and a still smaller percentage of attendance. There are a great many people who are interested as associate members who would go to a convention, and who can represent a great many of the central stations which are not at all represented here. There are a great many small companies which perhaps cannot afford to send their representatives. This gives a chance for members who do not send any of their own officers to be represented in the meetings; and that is my object in offering this amendment.

Judge ARMSTRONG: May I ask the purpose of this Association? If the purpose of the Association is to bring central station men together, who are interested in sending out commercial light and power—if it is to get a large convention to come in under another name, why, then the other amendment will do that, to be sure. We can send a dozen representatives from some of the large houses, representing as many more companies. But then see what you have got. You have not got an association such as Mr. Whipple wants, or such as every member of this Association wants.

Mr. ALEXANDER: There is another reason why that ought not to be adopted. Only yesterday a gentleman told me that he was going to force a certain measure through, and he said that it was merely a question of money. He meant that he could go around to a hundred central stations that have no membership, and say to them, "I will pay your dues, and you can give me your membership." He can do that, and then he can come here and rule the whole Association. Only yesterday that thing was proposed to be done.

Mr. WHIPPLE: They could have these proxies so that one man would represent only one company.

Mr. DECAMP: My object in making this exclusively a central station representation is that those who are here as representatives of central stations shall represent them in fact; that they shall be men, who, when they come here as the representatives of a company can state to this convention anything in connection with that company; men who are familiar with its operations in all particulars, and who may give this Association the benefit of what they know in fact about the operations of their stations. If you bring them here otherwise, and simply as nominal representatives; if, as Mr. Alexander suggests, a man can go to a company and say, "I will represent you in that association, even to the extent of paying for your membership," or, even if the company itself pays the $20 for membership, and wants such a man to represent it, he is of no value to the members here. I will illustrate what I have always found myself to be the case, without reference to such a point as this being raised. I come from Philadelphia, and represent four distinct corporations whose experiences all vary one from another. I am perfectly competent to discuss anything in connection with any matters which may come up of interest to these companies. I could represent three other companies, but my representation of the other three companies would not be worth anything, because I have only the most trivial information as to what are the real facts in the case of those companies. I see their financial reports once a month, but pay very little attention to them. In fact I do not know anything about them, and I could not benefit the Association by representing those three companies. But I do claim that in representing the four companies with which I am entirely familiar this Association can be benefited by my membership.

Mr. WILMERDING: That is precisely the point that I was trying to reach. I have a small amount of stock in three small companies in Michigan. Practically speaking, I do not know anything about the operation of any of those three companies. Why should I be allowed to represent these three companies? I am not an officer, and only a stock-holder. What I am trying to get at is this: If you allow a stockholder, or a properly accredited representative, to represent that company, I am perfectly willing that he should be a delegate, so as to represent any one of the officers, and so as to provide against the results that Mr. Alexander refers to. Mr. DeCamp represents four companies. True, he is an officer. I am merely a stockholder in three companies. Why cannot I represent those three, or any one of them? That is what I am trying to get at?

Mr. DUNCAN: The point that Mr. DeCamp makes is that he, as representing four companies, can better represent their interests than four separate men could do, although they are practically engaged in the business.

Mr. DECAMP: I do not say that I can do it better, but it is simply a matter of convenience. I have heretofore had a representation from each one of those companies.

Mr. DUNCAN: The point is this: If I want information from central station men who are actually engaged in the business, that we are losing the experience of the four; but that is not the fault of the Association, it is the fault of the companies in sending them in that way; consequently they are at a loss, and not the Association, except as the Association loses the influence of four men's minds upon a problem, instead of one. As I understand Mr. Whipple's

proposition, it is to limit the representation in some way by requiring certain credentials. He wants to know if he comes here with certain credentials over the official seal of the company can he be a representative of that company. I believe under the law as already passed in the first section that he can be.

Mr. DeCamp: I think that perhaps this can be covered in the proper place by an amendment, or perhaps by making a subsequent section. There is one thing you do not seem to understand clearly. I said that I represented four companies, and heretofore I have had an individual representative of each of these four companies, but only for the purpose of the voting power. I think that, aside from the assistance that one would naturally have from additional representation, I can fairly represent those four companies because I know all about them. As to the other three companies that I speak of, the only value that they would have as active members would be their voting value, because they do not add to my information in the least--and which information I want to transmit to the Association.

The President: Are you ready for the question?

Mr. Wilmerding: I would like to ask for some information. I want to know whether the company that I represent, and which I am connected with—the Chicago Underground Company—would be entitled to membership in this Association. It is a company owning subways and renting space.

Judge Armstrong: No; it would not be.

The President: The question is on Mr. Whipple's proposed amendment.

Secretary Foote: The amendment offered by Mr. Whipple is to this effect: In Section IV. (the one printed as Section II.) after the word "Superintendent" in line 10, add the words "or by a properly accredited representative."

Mr. Alexander: I move that that amendment be laid upon the table.

The motion was carried.

The President: The next to be considered is Section I. of Article IV. The Secretary will read it.

Judge Armstrong: If there is no objection--and I suppose that there is none--I move that Sections I. and II. of Article IV. be approved.

The President: Unless I hear an objection they will stand approved. Sections I. and II. of Article IV stand approved. The Secretary will read Section III.

Secretary Foote: Mr. Armstrong moves that Section III. be adopted.

The President: Unless I hear an objection it will be adopted.

Mr. Wilmerding: I do not think that Section IV. of Article III has yet been adopted. There was an amendment to it.

The President: I said that unless I heard an objection it would be adopted. Of course, it was equivalent to the report of the committee—the committee having accepted the amendment.

Now, as to Section IV. Unless I hear objection it stands adopted.

Now as to Section V.

Judge Armstrong: I move that we adopt that section.

The President: There being no objection it is accepted.

The next is Section VI.

Mr. DeCamp: I would like to offer an amendment to that section, so that it shall read as follows:

"Section VI.—The Executive Committee shall be the governing body of the association, and shall manage its affairs, pass upon all applications for membership subject to this constitution and such special rules or regulations as may be adopted by the association from time to time, and five members of the committee shall constitute a quorum."

I would amend that by adding after "membership" the words "and the eligibility of their representatives."

Mr. Garratt: I do not hear that. What is the amendment?

Mr. DeCamp: "And the eligibility of their representatives."

Mr. Alexander: On behalf of the committee I accept that amendment and move its adoption.

Mr. Duncan: Does that mean that they shall pass upon the credentials of the people who come to the meetings of the Association; or does it mean that they shall pass upon the eligibility of men applying for membership?

Judge Armstrong: Their eligibility for membership.

Mr. Duncan: I object to that, for a man has a perfect right to step into a meeting and present his credentials and have them passed upon. You pass upon the eligibility when you pass upon the membership. If a man comes up with credited credentials over the seal of a company I do not see why this body should not attend to that instead of the executive committee.

Judge Armstrong: That is already accomplished by placing a provision in the constitution. The laws of the State of New Jersey require that no stock except that owned by individuals shall be voted; and that no stock transferred within 20 days prior to an election shall be voted upon. Therefore, if 15 days before an election a man walks in with my certificate of stock and says to the tellers, "I want to vote on that stock," the company does not pass upon the question of his right to vote; the law has fixed it. We, by our law, say that a certain committee shall do a certain thing. We might as well say that no man shall represent a member on this floor unless five days before a meeting of the Convention he had sent his credentials to the Secretary. We simply pass upon his right to vote, as we have a perfect right to do under our constitution.

Mr. Duncan: I am not disputing your right to do it; I am merely suggesting it as a question of policy—whether it is not better to allow the body itself to pass upon their own credentials than it is to put it into the hands of a committee.

Mr. DeCamp: The answer that I have to that, and what I want to cover, is simply this: If you do not, you have what is equal really to proxies; because, as some one has said here, that they can go and represent a dozen companies.

Mr. Duncan: They cannot do it under this constitution.

Mr. DeCamp: Yes, they can. Suppose that a company in Michigan, or in Wisconsin, or in Texas, is a member of this Association, and some good friend goes to that company and says, "I will represent you." They are indifferent about it, and they do not take into consideration the fact that the man may have the worst kind of an object in wanting to be the representative of that company. Such a representative is of no benefit to the Association.

The President: The Chair will suggest that that is all covered by Article XI., which says that there shall be no voting by proxy.

Mr. DeCamp: This would not be voting by proxy. If membership of the company itself is a free pass to anybody who may seek a representation under that thing, why then you have the power without getting proxies, which amounts to the same thing. It is just in this matter of membership where you leave the door wide open. One member here is a director in 20 companies—or some outrageous number, more than he can attend to; and he can come in here and vote for each one of them. He does not represent them: he cannot represent them; he is not in a position to represent them. Therefore, I say that this committee should assume the power to say whether companies appear by proper representatives.

Mr. Duncan: The point I make is probably not understood. In the first place, we pass upon membership through this committee, under this constitution as proposed. A man having paid his dues, that fact would certainly settle the question of membership as far as he is concerned. Why should you then turn right around--being a body acting under your own constitution, and you being the peer of any man on the floor, and be compelled to send your credentials back again to that same standing committee? If Judge Armstrong thinks that is good law, I am satisfied. It may be good law, but I do not think it is good policy.

Mr. Wilmerding: When a man comes here his credentials ought to be presented and be passed upon; and they may as well be referred to the Executive Committee as to any other.

Mr. Duncan: I am not disputing whether it can be done, but questioning whether it is a matter of good policy to do it.

The President: The question is on the section as amended.

Mr. Alexander: I move that it be adopted as amended.

The motion was carried.

Mr. Alexander: I move the adoption of Article V.

The President: Unless I hear some objection it is adopted.

Articles VI. and VII. were adopted.

Mr. Whipple: If you will notice Section V. of Article IV. you will notice a discrepancy between that and Article VIII. Section V. of Article IV. provides that the secretary and the treasurer shall be nominated by the President and ratified by the Executive Committee: whereas Article VIII. provides that all officers shall be elected by ballot. I move to amend Article VIII. I did not move to amend Section V. of Article IV., but now I want to call your attention to the fact that there is a discrepancy, and I move to amend Article VIII. by inserting in line 47 after the word "officers" the words, "except the secretary and the treasurer."

Judge Armstrong: The committee accepts that amendment. That makes it verbally correct.

Article VIII. as amended was adopted.

Articles IX., X., XI. and XII were adopted.

Mr. Garratt: I would like to present a new article, to be known as Article V., and the subsequent articles to be set ahead one number, so that Article VI. would become Article VII., and so on. I move the adoption of this article:

"Article V. No individual actively associated with a corporation holding active membership shall become an active member individually, unless he shall own or operate a central station plant individually."

Mr. DeCamp: I second that, for the same reason that I offered the amendment substituting the Committee on Credentials for the Executive Committee. The way it stands now it makes it possible to vote by proxy. For instance, I might take the Brush Electric Light Company, of Philadelphia, which holds a membership which I represent here, and I might send three or four of the employés of that company who are acting in various capacities, and who might come directly under the provision made here for membership, and pay their dues, and have them come here and multiply my vote by just the number that I might desire. That would not be right, because it is giving one company more than one vote.

Mr. Wilmerding: Would it not be just the same thing as if you cast four or five votes yourself.

Mr. DeCamp: I cannot cast four or five votes myself. I might take our superintendent, pay his dues as a member, and say that he is actively engaged in this business, and make him a member.

The President: Mr. Garratt moves that as Section V. of Article III. It is moved and seconded that it be adopted as a part of the Constitution.

The motion was carried.

Judge Armstrong: Now, if in order, I offer this resolution:

Resolved, That the report of the Committee on the Revision of the Constitution be accepted and adopted, and that the new constitution take effect Jan. 1, 1891.

The resolution was unanimously adopted.

Mr. Duncan: Now I move that the revised constitution be referred back to the committee for proper revision, in connection with the Secretary, for publication. There have been so many amendments made here, and so many suggestions made that it would be hard for any one man to keep the record straight. I would suggest that it be referred to the chairman of the committee in connection with the secretary of the association for revision.

The motion was carried.

Mr. DeCamp: I move the appointment of a Committee on Nominations.

The President: The Chair will announce the Committee on Nominations at the opening of the afternoon session.

Mr. DeCamp: I move that the same committee be instructed to name the place for the next meeting.

The President: The Chair will announce that committee at the opening of the afternoon session.

Before we adjourn I want to give Prof. Barrett an opportunity to ask the question that he desired to ask this morning. As Mr. Francisco is here, he can ask it now.

Mr. Barrett: I prefer to have it put off until the afternoon meeting.

The President: We have all that we can do this afternoon.

Mr. Barrett: Very well. I want to ask Mr. Francisco where he secured the figures with regard to the expenditures in Chicago?

Mr. Francisco: In answer to Mr. Barrett's question, I will say that Mr. Barrett is too good a politician, and understands the working of these matters too well, to expect that I would disclose the name of the person in Chicago who gave that information. He is inside of that combination, or whatever you call it. The information was given to me from parties who are perfectly reliable; and of course Mr. Barrett knows perfectly well that when such things are given in confidence they are not to be disclosed

Mr. Barrett: I do not understand you.

Mr. Francisco: I mean that I would not give away any man in Chicago after he had given me that information.

Mr. Barrett: Is not the matter of expenditures in any department of the city government a matter of public record?

Mr. Francisco: Is this a matter of public record in Chicago?

Mr. Barrett: Certainly.

Mr. Francisco: All of these things?

Mr. Barrett: Certainly.

Mr. Francisco: Then can you tell me just where the expenses of the electric light business in Chicago is charged?

Mr. Barrett: I was just going to make a suggestion, if you refuse to answer my question--which, evidently, is not in accordance with honest treatment. I came here with very great respect for this Association. I expected to accord an honest answer to any question asked me, and I expected that in return. Now, sir, your expense account here runs up to—let me ask you what were those figures—for what year?

Mr. Francisco: Those figures were given me for last year.

Mr. Barrett: It is just the expenditure to maintain the 275 lights.

Mr. Francisco: If Mr. Barrett can read the English language he can see exactly what it shows. It gives the wages paid the different men, and the amount charged up for depreciation; and that depreciation I figured myself. The other figures are actual figures as given me as paid for those items. There they are in plain language. There is no chance for misconstruing or evading them. There they are, and I am here to sustain them.

Mr. Barrett: I want to say for the benefit of the Association that there are but two items throughout that statement correct--one is the salary of the engineer, and the second is the number of lights. As to the total expenditure as charged by you there is the slight difference between that and the actual expenditure, and what you credit as expenditure, of $35,190.

Mr. Francisco: I do not intend to reflect in any way upon the city of Chicago or upon Mr. Barrett, but it has gone broadcast over the country that it only cost 19 cents per night to furnish light in Chicago.

Mr. Barrett: I tell you now that it does not cost that much.

Mr. Francisco: The statement that it does not cost so much is a question that we will not enter into now. It is just a question of controversy between us.

Mr. Barrett: I want to offer this suggestion—I want to ask if you desire to send broadcast the truth about municipal lighting, and if you do, that you will appoint a committee, of whom you please, except this gentleman here, and excepting him only, and I will pledge you my word of honor that they shall see every document relating to public lighting in Chicago from the date of its inception to the present time, and if it sustains that statement I will pay the expenses of this committee. I appeal to you gentlemen, if there is anything more honest or square than that I want to make it.

Judge Armstrong: If Mr. Barrett will allow me I will make a suggestion. We cannot come here and undertake to weigh as between statements made, so as to prove the truth or the falsity of the statements made here. Mr. Francisco has presented here a document which is clear and unmistakable in its statement. If Mr. Francisco is wrong, then Mr. Barrett can by the facts and figures refute the statement without our sending any committee there; and we will accord him just exactly what we have accorded to Mr. Francisco—no more and no less. He can send a statement of just exactly what his expenses are and can answer the questions that have been asked, and he can prove his statement just as well as any committee can do. Such a statement we would be glad to receive; it will be just the information that we want; and if he would send it to the Secretary I have no doubt that the President or the Executive Committee will order it sent to each member of the Association.

Mr. Barrett: This Association has never asked me for any figures on anything. I have been overwhelmed with questions, so that within the last three or four months I have refused to answer them at all, as to the expenditures for maintenance of lights in the city of Chicago. I had no reason to cover up any expenditure there. I have more at stake than anybody else. I know what that light costs. Any citizen of Chicago, or any visitor has a perfect right to inquire into the expenditure. All that I want, all that I ask, is honest and square treatment. I want it at the hands of this Association. I want your treatment to be as liberal as your criticism is. I leave it with you to use any methods to acquire the information.

Judge Armstrong: I move the adoption of a resolution which I will dictate to the stenographer:

After hearing the statement made by Prof. John P. Barrett in relation to the municipal lighting of Chicago.

Resolved, that Prof. Barrett be requested to communicate to this Association a statement showing the cost of producing and maintaining electric lights in the city of Chicago.

Mr. Barrett: Let me suggest that it include the cost of construction also.

Mr. Garratt: That is not broad enough. We have now indorsed a paper of the Association, and ordered it sent broadcast. Now comes an assertion that certain statements, whether obtained in one way or another, are disputed by the man who has the data in his possession, and who offers to furnish it to this Association through its committee, or through any one else. Now I would suggest that you go further than this resolution does, and when you get that information over an official signature that you direct or authorize it to be published broadcast in connection with the document that this Association has put out, and you will have the two statements before the public; and then you will be in the position of doing equal justice to all parties; otherwise you will not be.

Mr. Weeks: I am perfectly willing to have this reply of Mr. Barrett's published broadcast after it has been brought before the Association and has received the examination that we will give it.

Mr. Barrett: Certainly. Yesterday, when this paper was read here it was ordered, as I understood, by this Association to be printed or published, so as to transmit it to the cities at large. He had not got off the floor when these things were handed around among the members of the Association. I was not in the room at the time, and was not in a condition to debate the question. It was sprung without my knowing and when I was unwell and not able to be here. I do not think it is fair or honest when I challenge the veracity of that statement that you should have

put it on the market the way you did. I think that you ought in justice to all parties concerned to give us an even show.

Mr. FRANCISCO: The Executive Committee reported, or directed that all the papers must be printed and brought in here and distributed to the members when they were read; and that they must be delivered to the Executive Committee 30 days before the meeting of the Convention. This year the papers came in so late that the committee did not get them in time to be printed, but, as I was a member of the Executive Committee, and knew what their rule was, that paper was printed in accordance with that requirement, and brought here and distributed among the members in accordance with the requirements of the Executive Committee. That is the way it happened to be printed.

Mr. BARRETT: There is the difference between your paper and mine. I wrote a paper, and asked the Secretary to have copies mailed back to me in Chicago; but I could not secure them.

Secretary FOOTE: Your paper reached my hands so late that all that I was able to do was to give it to the electrical journals. They set it up in galley proof, and a copy was furnished to each one of the journals so that they might have it in time for use in their issues. To get copies of all the papers for the Association, as was contemplated by the resolution, was an impossibility; as they only reached my hands after I left New York. I left directions at my office to have this paper handed over to the journals.

Mr. BARRETT: It appeared to me—and I have felt a little bit sore about it—that this paper was sprung without a fair and square investigation of it. I am to blame for it, because I was unable to be here, and I did not see these figures until I was sitting at the dinner table. I tell you they are wrong. They are not right in any particulars except those two that I have named. I want you to give me as fair treatment as you gave Mr. Francisco.

Mr. DECAMP: There will be no question about that if we have the figures from you.

Mr. BARRETT: I do not think that putting this pamphlet out the way you have is doing us justice. I intended this morning to ask for a reconsideration of that vote, and to have a committee appointed for the investigation before the pamphlet was furnished to the public.

Mr. DECAMP: I do not think that there will be any objection to withholding the paper until your statement is ready to go out with it.

Mr. BARRETT: If you will do that I am satisfied.

Mr. DECAMP: When will you give us that statement?

Mr. BARRETT: I will give it any time you wish. I shall not be at home for two weeks.

Mr. DECAMP: The sooner the better.

Mr. BARRETT: Whom do you want it to go to?

Mr. DECAMP: To the Secretary.

Mr. BARRETT: I will give you that paper inside of one month from to-day.

Mr. DECAMP: All right.

Mr. ARMSTRONG: I move the adoption of that resolution. I will add to the resolution that it be referred to the Executive Committee.

The resolution was adopted.

The Convention then took a recess until 3:30 P. M.

AFTERNOON SESSION.

The PRESIDENT: The Convention will come to order. The Chair will appoint on the Committee on the Columbian Exposition: P. H. Alexander, Oldtown Electric Light Company, Oldtown, Me.; George H. Rose, San Francisco Electric Light Company, San Francisco; S. J. Hart, Louisiana Electric Light Company, New Orleans, and Mr. Edwards, of the Charleston Electric Light and Power Company, Charleston, S. C. I thought, as it was a committee whose work would interest the whole country, I would make it to cover all sections. We will now listen to the report of the secretary and treasurer.

Secretary FOOTE read the report of the secretary and treasurer, as follows:

REPORT OF THE SECRETARY—MEMBERSHIP.

Active members, dues paid	79
Active members, dues unpaid	28
Total active members	107
Associate members, dues paid	128
Associate members, dues unpaid	34
Total associate members	162
Total membership, July 1, 1889	269
Total membership, Jan. 1, 1890	259
Gain in membership for the six months	10

REPORT OF THE TREASURER.

Balance Jan. 1. 1890	$610.17
Received from Jan. 1 to July 1	3,020.00
Total to be accounted for	$3,630.17
Expended from Jan. 1 to July, per approved vouchers on file	2,396.57
Balance in bank, July 1, 1890	1,233.60
Total accounted for	$3,630.17

Mr. GARRATT: Mr. President, I move that the report of the secretary and treasurer be received and spread upon the minutes.

The motion was carried.

The report of the Finance Committee was then called for.

Mr. GARRATT: Mr. President, I have got to get down to the train, and I wish to present a resolution, if I may do so.

The PRESIDENT: You may do so.

Mr. GARRATT: At the Kansas City Convention there was a committee appointed to draft resolutions on the death of two of our members. I caused two copies of these resolutions to be engrossed, which I will read:

Preamble and resolutions adopted by the National Electric Light Association at its Cape May Convention, Aug 19-21, 1890.

The Special Committee, composed of the following undersigned members, appointed at the Kansas City Convention of this association, in February of this year, unanimously recommend the adoption of the following preamble and resolutions, to wit:

Whereas, In the course of Divine Providence our fellow member has been taken from our midst by death, and

Whereas, It is our heartfelt desire to express individually and collectively our sorrow, and to extend to those who are endeared him by the ties of kindred our sympathy; be it therefore

Resolved, That in the death of our fellow-member, Mr. Miles W. Goodyear, this association has sustained the loss of one whose integrity of character and many noble qualities have endeared his memory to us, and whose well-directed efforts in the arts and sciences pertaining to electrical industries, as well as his long and honorable connection with this Association, have earned our esteem; and be it further

Resolved, That we hereby extend to the members of his family our deepest sympathy and condolence; and be it finally

Resolved, that the Secretary is hereby instructed to spread these resolutions upon the minutes of this Association, and to transmit a true copy thereof to his family.

F. E. DEGENHARDT, Chairman.
WILLIARD L. CANDEE,
ALLAN V. GARRATT.
Committee.

I have had two copies engrossed, one in the name of Mr. Goodyear and the other in the name of C. McIntire.

Mr. SEELY: I move that the report of the committee be received and the committee discharged.

The PRESIDENT: If there is no objection that motion will be adopted by a standing vote, in honor of the deceased members.

All the members present rose.

The PRESIDENT: Next is the report of the Executive Committee—Mr. Huntley.

Mr. HUNTLEY: Mr. Chairman, the Executive Committee have no written report, but its work has been shown perhaps in this meeting. It has had several meetings at the call of the chairman, and if it would be of interest the secretary could give the records of those meetings. I don't know that that would be material. As that committee is now at an end I would ask that the work of that committee be received and that the committee be discharged.

The Chair announced as Committee on Nominations for Executive Committee: Messrs. Edgar, DeCamp, Armstrong, Long and Alexander.

Dr. MASON: Mr. Edgar has gone from the city.

The PRESIDENT: I will name Mr. T. Carpenter Smith. Will the chairman of the Committee on Finance render his report now?

Mr. SEELY, chairman of the committee, read the report as follows:

REPORT OF THE FINANCE COMMITTEE.

1. The books of accounts have been audited to July 1, 1890, and have been found to be correct. The financial statement is as follows:

Balance Dec. 31, 1889	$610.17	Disbursements	$2,396.57
Receipts	3,020.00	Balance June 30, 1890	1,233.60

2. During the six months covered by this report $725.02 of bills contracted previous to Dec 31, 1889, have been audited and paid. This shows the disbursements for bills contracted from Dec. 31, 1889, to June 30, 1890, $1,671.55.

3. Two volumes of reports of the Tenth and Eleventh Conventions have been published and are now ready for delivery. By resolution of the Executive Committee, the Secretary, Mr. Garratt, was authorized to contract for advertisements to be printed in each volume. Under this arrangement the cost of publishing these two volumes, Vol. VII. and Vol. VIII., 500 copies of each, bound in cloth, is as follows:

Printing	$1,039.80
Binding	140.00
Wrapping for mailing and sundries	10.00
	$1,189.80
Income from advertising	976.60
Balance, net expense to Association	$213.20

4. In looking over the accounts, the committee has noted one change in the business methods of the association that, in its opinion, can be made with advantage. It relates to the payment of expenses incurred by the committees. Your committee recommends that, hereafter, whenever a committee is appointed, the Executive Committee shall fix the maximum amount it will allow for the expenses of such committee, and notify its chairman that vouchers for the expenses of his committee will be allowed within the limit specified, and no more.

5. The Committee finds that the accounts of the Association are being kept in single entry, and without a ledger of accounts. Your committee recommends that the Secretary be directed to open a new set of books of date of July 1, 1890, to be kept in double entry system, and that the following be among the ledger accounts to be kept:

RECEIPTS.	DISBURSEMENTS.
1. Active members' dues.	1. Rent.
2. Associate members' dues.	2. Salaries.
3. Sale of Proceedings.	3. Postage and telegrams.
4. Advertising in Proceedings.	4. Printing and stationery.
5. Donations.	5. Publishing Proceedings.
6. Sundry sources.	6. Committees (an account for each).
	7. Furniture.
	8. Sundries.

Respectfully submitted for Finance Committee.

JOHN A. SEELY, Chairman.

Mr. SEELY: I will further state that we find that there has been no inventory kept as to the property of this Association, and the committee have notified the Secretary to report to the Executive Committee as to all property belonging to this Association that is located in their office.

The PRESIDENT: Gentlemen, you hear the report.

Mr. WEEKS: I ask for information if this is a committee of the Association or a sub-committee of the Executive Committee.

The PRESIDENT: This is a sub-committee of the Executive Committee.

Mr. WEEKS: And this is a part of the Executive Committee's report and will be so spread upon the minutes?

The PRESIDENT: It can be done in that manner if you prefer it. The Executive Committee themselves have really reported no action that they have taken; therefore I ordered no action at all upon their report, because they reported no important matter. Do I understand that your motion is to consider this as the report of the Executive Committee?

Mr. WEEKS: I made no motion. I asked for information, and in asking for information I may have conveyed a suggestion that that would be the proper way.

Mr. BURLEIGH: I move that that portion of the Executive Committee's report be received and filed and the recommendations carried into effect.

The motion was carried.

The PRESIDENT: Report of Committee on Underground Conduits and Conductors, Joseph E. Lockwood, chairman. I understand that Mr. Wilmerding, of Chicago, will present that report.

Mr. WILMERDING: Mr. Lockwood has forwarded to me the report which he has made up for the Committee on Underground Conduits and Conductors, and asked me to present it to the Association, as he could not be here himself; and I have looked over it and submitted it to Mr. T. C. Smith, who is the only other member of the committee present, and we both endorse the report. It is as follows:

REPORT OF THE COMMITTEE ON UNDERGROUND CONDUITS AND CONDUCTORS.

GENTLEMEN: At the Kansas City Convention, held last February, the following members were appointed a Committee on Underground Conduits and Conductors, viz.:

J. E. Lockwood, of Detroit, Mich.
C. H. Wilmerding, of Chicago, Ill.
S. S. Wheeler, of New York.
T. C. Smith, of Philadelphia, Pa.
D. E. Evans, of Baltimore, Md.

Your committee now desire to report that they have perfected a plan of work, but before carrying out same desire the opinion of the Association, and any suggestion that members, especially interested, may desire to make.

The plan of work adopted is, first to secure from each electric light or power company, operating any high tension underground conductors a full description of the conduit and conductors in use, the character of the current used, and how long same has been in use, which information, when classified and tabulated, will indicate plainly the condition of the subject at the present date, and will give us a starting point to work from. We then intend to secure the co-operation of these companies in our next step, which will be to have each company keep account of the cost of maintenance and repairs to the conduits and conductors, and of all changes or additions thereto, also of the average hours per day the system is operated; this information when classified and tabulated will show the cost of operating underground conductors, and if regularly reported to the committee will show whether or not progress is being made in this direction, and whether the systems in use are likely to prove permanently successful or to finally fail.

It is also designed to include in these reports a list of all grounds, burn-outs, etc., and their causes, with suggestions looking to the removing of said causes.

The committee would of course keep private the names of all companies furnishing such information, simply reporting same in tabulated form. These reports would be invaluable to companies operating such conductors, as they would have, not only their own experience to improve upon but also that of all other companies operating underground conductors.

In regard to the details of the plan of work proposed, we have decided on first obtaining the following information, viz:

Conduits.

1. A full description of the conduit used, kind of man or hand holes, provision for taking off service, etc.
2. Mileage of conduits laid and in use.
3. Mileage of duct laid and in use.
4. Number of manholes.
5. Number of handholes.
6. Length of time in use.

Conductors.

1. Description of the conductor in use, stating size of conductor, kind and thickness of insulation, and if insulation is covered, in what manner.
2. How long same has been laid and in use.
3. Mileage of conductors laid and in use.
4. Average hours per diem same is operated.
5. Electromotive force and character of current used.

The above information would give us a good basis to work on we would then endeavor to have each company operating high tension underground conductors, keep the following records, and report same regularly to the committee, just before each Convention, so that same could be properly classified, tabulated and recorded.

RECORDS.

Conduits.

Mileages of conduit laid and in use.
Mileages of duct laid and in use.
Number of man holes.
Number of hand holes.
Number of services taken direct from conduit.
Cost of maintenance per month.
Cost of repairs per month.
Description of any new work done since last report.
Troubles with conduit man or hand holes and suggestions as to how same can be remedied.

Conductors.

Mileage of conductors laid and in use, number of circuits and mileage of each.	Average hours per diem circuits are operated.
Cost of maintenance per month.	Voltage and character of current used.
Cost of repairs per month.	Changes or new work.
Number of burn-outs and causes.	Mileage of conduit or conductors abandoned.
Troubles of other kinds and causes.	Mileage of conduit or conductors added since last report.
Suggestions as to how troubles can be remedied.	

The above reports would, of course, be separately classified for different kinds of conduits, conductors and currents.

Your committee think that these records should be kept continuously and reported regularly, until the question of operating high tension underground conductors is solved or effectually disposed of and to do this we recommend that the committee be made permanent, and that members be elected annually at the February Convention.

The committee should report at each convention: The number of companies operating high tension underground conductors; the mileage of conduits, ducts and conductors in use; the cost per mile per month of conduit maintenance and repairs; the cost per mile per month of conductor maintenance and repairs; the average number of burn outs and grounds per mile of conductors used, and the causes.

Also report all conduits, conductors, etc., that had proved failures and were abandoned.

In this manner the association would keep thoroughly posted regarding the progress of the subject and would be supplied with the actual records made by the different systems; the members of the association could then judge for themselves of the success of the different systems and thus be able to act intelligently, in case they desired to do any work in this line.

As this plan is intended to extend beyond the time for which this committee was selected, we have recommended that same be adopted by the association and that provision be made for the annual appointing of members to the committee.

If this meets the approval of the convention we would appreciate any suggestion from members who are especially interested in this subject looking to the perfecting of the plan of work.

I would say in addition to that that I think Mr. Lockwood has omitted one point, in regard to the cost of the conduit that is down. That cuts a very important figure in the estimate of what it really means to operate underground conductors, and the committee I think ought to have the privilege of adding any such questions to their catechism which they will submit to these other companies using underground work, which they think may be necessary.

The PRESIDENT: You hear the report, gentlemen. What is your pleasure?

Mr. DECAMP: Mr. Chairman, I would move, inasmuch as the report is mainly a recommendation for future operations, all of which commend themselves to me, including the verbal statement of Mr. Wilmerding, that the report be received and the committee continued.

Mr. FRANCISCO: I second the motion.

The motion was carried.

Mr. WILMERDING: Mr. President, that carries with it, suppose, the power to go on with the investigations?

The PRESIDENT: As I understand Mr. DeCamp's motion, it not only carries with it the power but the approval of your plan, and the continuation and carrying out of the plan you have suggested, with such additions as recommend themselves to you from time to time. That was the intention?

Mr. DECAMP: That was the intention; that was the spirit of my motion.

The PRESIDENT: The report of the Committee on Rela-

tions Between Manufacturing and Central Station Companies will be read by Judge Armstrong, a member of the committee.

Mr. ARMSTRONG read the report, as follows:

REPORT OF COMMITTEE ON RELATIONS BETWEEN MANUFACTURING AND CENTRAL STATION COMPANIES.

The vast sums of money invested now as capital in the United States in the various electric light and power companies makes the subject with which this committee has to deal more than ordinarily important.

From every point of view the policy that has been more or less surreptitiously pursued by parent companies in *permitting* their agencies for the sake of a present sale of apparatus to foster and encourage improper and hurtful competition with present central station companies cannot in our judgment be too strongly condemned by this association.

Capital has been induced in spite of its proverbial timidity to invest in what has been an unexplored field. Often this investment has been brought about by the parent companies themselves. Then when it has seemed as if the stormy days of doubtful experiment were about over, and there was some little possibility that this investment might begin to make returns, along comes the agent of some parent company, and by specious representation induces other citizens of the same place to start a new plant, always forgetting to tell of the weary journey of the pioneer company, and pointing always to present position. The only province of this new plant is to damage and destroy what did give some promise of life and fruit; and incidentally to make a market for a little new apparatus, effectually closing, however, a profitable avenue of steady continuing business in sales to the original companies.

It is rumored very strongly, and indeed stated as a fact, as strange as it may seem, that parent companies, not satisfied with permitting, have gone so far as to organize central station companies in competition with others which are abundantly able to supply all demand, strengthening, supporting and sustaining them in their unholy warfare against legitimate enterprise.

Such being the case your committee would earnestly recommend either its continuance or the appointment of a new committee with power to confer and advise with any companies against whom such warfare is waged, and that through such committee the members of this association as central station companies, pledge sympathy, assistance and protection to any company so being fought; and that such committee be instructed to represent to the various parent companies that the conduct we have above deprecated is something so fatally injurious to us and to our stockholders as to make our investments uncertain and undesirable, and that therefore we will as one association feel not only justified in, but required to take the strongest possible means of remedy and prevention within our power, whenever we find a parent company engaging in or permitting such a course of conduct. When it has already been started, any such company so minded can readily stop it.

Mr. BROWN: I move that the report of the committee be received and the committee continued.

The motion was carried.

The PRESIDENT: The next in order is the report of the Committee on Data, A. J. DeCamp, chairman.

Mr. DECAMP: I am in rather an awkward position in reference to the report of this committee. I have a report here which has been formulated, and I have not been able to confer with the majority of the committee as to the final presentation of it. I therefore speak mainly on my own responsibility, and make the report that of progress, and ask for a continuance of the committee. That is open for any suggestion any one may make.

The PRESIDENT: The majority of the committee have not been able to come together—owing to the pressure of business, I suppose—and determine fully on a report which has been formulated. They therefore ask you to continue them and they will report at another session.

Mr. ALEXANDER: I move that the committee be continued.

Mr. SEELY: I second the motion.

The motion was carried.

The PRESIDENT: Topic: Proper Care and Management of Alternating Currents; T. Carpenter Smith, Philadelphia.

Mr. Smith bids me to say that that paper was promised for the next convention, not for this, and by error was put down on the programme for this convention.

The PRESIDENT: Topic: How the National Electric Light Association can best Serve the Interests of Central Station Companies; C. R. Huntley.

Mr. HUNTLEY: Mr. President, some time ago Mr. Lockwood asked me to write this paper. I felt that I was inadequate to the task. I feel so now. I think, however, that the paper or the topic might be discussed under another heading, and better still: How can the central station men best serve the National Electric Light Association? As we look about us to-day here, we see perhaps 35 or 40 central station people; in fact they are in the minority. We find a great many supply men here taking an active part in it; but, conspicuously, the central station men are not as active in their membership or in respect to their pocket-book to aid the National Electric Light Association as they might be. I think, to put the whole matter in a nutshell, that the National Electric Light Association should be purely a business association, and in being that they will best serve the central station men.

I have nothing more to say upon the topic.

The PRESIDENT: The report of the committee to nominate an executive committee for the ensuing six months and to name a place of meeting is in order.

Mr. T. CARPENTER SMITH: The Nominating Committee have met, and they unanimously recommend as the next place of meeting Providence, R. I., the time to be announced hereafter by the Executive Committee. (Applause.) They have also unanimously concluded that it is only due to the Executive Committee and to the work which they have so thoroughly done, to continue that committee, the only change to be made being the substitution of Mr. A. J. De Camp for Mr. Thurber, by request.

The PRESIDENT: Gentlemen, you have the report of the committee. What is your pleasure?

Mr. SEELY: I move that the report of the committee be accepted and the committee discharged.

The motion was carried.

The PRESIDENT: The election of the Executive Committee, I presume, must be proceeded with by ballot.

Mr. DECAMP: I move that the Secretary cast the ballot for the nominees.

Mr. ALEXANDER: I second Mr. DeCamp's motion.

The motion was carried.

Secretary FOOTE: I announce the ballot as cast, as follows:

For members of the Executive Committee: C. R. Huntley, Chairman; E. R. Weeks, C. H. Wilmerding, J. J. Burleigh, M. J. Francisco, J. A. Seely, James English, A. F. Mason, A. J. DeCamp.

The PRESIDENT: Those gentlemen are elected. Will you take any action on the place of meeting?

Mr. ARMSTRONG: I move that the recommendation of the committee be adopted.

The motion was carried.

The PRESIDENT: Unless there is some other business to come before the Convention, it will be in order to adjourn.

On motion of Mr. Seely, the Convention adjourned.

CONVENTION NOTES.

Mr. James F. Kelly represented the Edison Manufacturing Company.

The Cleverly Electrical Works was represented by Mr. H. A. Cleverly.

Mr. Robert McMath represented the St. Louis Board of Fire Underwriters.

The South Eastern Tariff Association was represented by Mr. John S. Alfred.

The interests of the Kerite wire were cared for by Mr. Geo. B. Prescott, Jr.

Mr. W. J. Hammer represented his own interests among the central station men.

Capt. W. L. Candee, of New York, took care of the interests of the Okonite company.

The C. & C. Motor Company was well represented by Mr. T. McCoubray and Mr. H. L. Lufkin.

The National Carbon Company was represented by Messrs. Smith and Miles, of Cleveland.

The Great Western Electric Supply Company was represented by its manager, Mr. Geo. Cutter.

J. J. Ryan & Co., of Chicago, were represented by a neat little description of their big brass foundry.

Mr. M. E. Baird, of the Eddy Motor Company, was at the convention, as handsome and jolly as ever.

The Edison interests were cared for by Mr. Wilfrid Fleming, Mr. W. J. Jenks and H. Ward Leonard.

Mr. Rodman represented the Globe Carbon Company, and cared for its interests in first-class shape.

Mr. C. S. Van Nuis was present to answer inquiries concerning his electrical switches for heavy currents.

The managers of the American Electrical Works, Providence, R. I., were represented by Mr. P. C. Ackerman.

The Electric Mutual Insurance Company, of Boston, was represented by Mr. S. E. Barton and Capt. Wm. Brophy.

Mr. John A. Seely represented the Seely & Taylor Manufacturing Company, and made an exhibit of the Seely compound.

Mr. C. J. Field was present to advance the interests of the Field Engineering Company, as well as to take part in the discussions.

Chas. A. Schieren & Co. distributed very neat circulars showing installations of their belting. Mr. E. P. Atkinson represented them.

The Standard Paint Company exhibited the P.& B. paints, electrical compounds, armature, varnish, insulating paper and other specialties.

Mr. A. B. Laurence, "the belt fiend" of New York, was at room 323, showing a full line of Shultz belting and patent pulley covering.

Mr. A Groetzinger, vice-president of the Munson Belting Company, of Alleghany, Pa., was warmly welcomed by many of his old friends.

The Pettingell-Andrews Company, of Boston, showed a fine line of "K. W." cut-outs. The firm was well represented by Mr. F. E. Pettingell.

The Walsh Gasoline Torch Company, Chicago, was represented by a quantity of printed matter showing the operation of its soldering torch.

The Jewell Belting Company, of Hartford, Conn., exhibited some very fine samples of its belting at the rooms of Mr. C. L. Tolles, its representative.

Mr. T. H. Brady, of the Brady Mast Arm Company, New Britain, Conn., had a very neat catalogue of his goods that he furnished to all interested parties.

The Metropolitan Rubber Company, of New York, through Mr. George B. Meeker, exhibited a new cheap hard rubber tube for insulating purposes.

Mr. Fred Whipple, of Detroit, Mich., was present to point out the value of his electrical directory and reports and to distribute sample copies of the latter.

Mr. W. W. Castle represented the P. & B. Conduit Company and exhibited samples of P. & B. conduits, armature varnish and electrical insulating compounds.

Mr. R. T. White, of Boston, exhibited his "daisy" chair and other patented material of his own invention to all street railway men, and to other interested parties.

Mr. G. S. Bowen, of Elgin, Ill., the first president of the Association, was present at the sessions of the convention, and met with a hearty greeting from his old friends.

Prof. F. B. Crocker and Dr. S. S. Wheeler were both present to represent the interests of the Crocker-Wheeler Motor Company. They made a very creditable display.

The Sensible Packing Company, Chicago, had a neat circular of value to engineers and superintendents of electric light plants which was distributed at the convention.

Mr. Frank P. Wisner represented the Consolidated Fruit Jar Company, of New York, and was very busy directing the attention of all visitors to the electric novelties of his company.

The Chicago Fire-Proofing Company exhibited samples of its mineral wool insulation for pipe and boiler covering, and distributed some printed matter of value to engineers and contractors.

The Pumpelly Storage Battery Company, Chicago, distributed a little pamphlet containing valuable information regarding storage cells and their application to various uses for lighting and power.

Mr. E. V. Cavell, of the *Street Railway Gazette*, Chicago, distributed copies of his excellent journal among the members, and found many electric light men who were interested in street railway work.

The Crosby Electric Company made a fine exhibit of J. H. Van Gestel's dry battery and other electrical novelties at the lower end of the main corridor. Mr. Van Gestel was on hand to explain the merits of his batteries.

The Bryant Electric Company, of Bridgeport, Conn., had a beautiful display of its double pole switches, new rosettes and cut-outs, the Orford pendants and Lewis fixture for operating key sockets by chain pendants.

The Seely & Taylor Manufacturing Company, of New York, had a fine line of novelties made of its compound on exhibition in one of the corridors. Mr. Seely was on hand to explain the merits of his appliances to his friends.

The Washburn & Moen Manufacturing Company distributed a very neat little hand-book crowded with useful data of the properties of copper and iron wire and other interesting facts concerning electrical appliances and industries.

Mr. O. S. Platt, manufacturer of the New England switch, Bridgeport, Conn., was among his friends at the convention, and was busy every day and for a large part of each night showing his switch to many interested electrical people.

The Nubian Iron Enamel Company, Chicago, had prepared a fac-simile of General Superintendent E. F. Peck's letter indorsing its enamel for arc lamps, etc., for distribution and these were supplied to a large number of central station men.

Wm. Baragwanath & Son, Chicago, had some excellent illustrations of their feed water heaters, purifiers and boilers, which were distributed to all who were interested in the economical generation of steam in central electric light and power plants.

Mr. J. R. Hogg represented the Connecticut Motor Company and made an excellent exhibit of a small motor of the company's latest type which was finished in the usual style with polished metal. The motor attracted considerable attention.

Mr. E. F. Woodman, Superintendent of the American Fire Alarm Company, Boston, made an attractive exhibit of his fire alarm system. The display was made in connection with that of the United Electric Equipment Company, of Philadelphia.

The Eureka Tempered Copper Company was well represented by Mr. A. L. Daniels. His excellent exhibit was well arranged, and attracted considerable attention. The display included commutator bars, wires, brushes, etc., made from pure copper.

The Norwich Isolated Wire Company, Newport, R. I., through Mr. Jean A. Wetmore, exhibited some underground arc light cables, which are especially adapted for high voltages. A recent test of nearly 10,000 volts failed to show any damaging effects.

The convention proceedings were admirably reported for the electrical journals and the Association Record by Mr. W. R. Ryan, with an able corps of stenographers and typewriters, consisting of F. A. Adams, Edmund F. Davis, F. H. Warder, E. Myerson and Clarence T. Davis.

Mr. H. H. Eustis carried a very complete exhibit of "Clark" wire in his coat pocket. It is even rumored that he placed it in the pocket of his bathing suit to ascertain the action of the sea water on the insulation of his wire. Only his nearest friends learned of his sale of 1,500,000 feet of wire.

The Okonite Company exhibited a beautiful sample board loaded with Okonite and Candee wire in all sizes, Okonite and Manson tape, and a specially fine assortment of lamp cord and aerial and submarine cables. A great pile of sample cards exhibited the smaller sizes of Okonite wire to good advantage.

Mr. A. M. Young, of Waterbury, Conn., who was at the convention, accompanied by his wife, has made a record as a "hustler," having already installed 23 electric light plants that are valued at over $4,000,000. Mr. Young has lately been elected a director of the Electric Mutual Insurance Company, of Boston.

The Sperry Electric Company gave a practical illustration of its triple carbon, single rod, 16-hour lamps and the Sperry double pole switch immediately in front of the Stockton. Charles E. Gregory, who represented this company, was the only person who succeeded in getting in on the local electric light circuit.

The good qualities of the friction clutch pulleys and cut off couplings of the Moore & White Company, Philadelphia, were well explained to central station men by Mr. W. H. Shoemaker, their representative. The same gentleman also cared for the interests of the Maine Belting Company, and made many friends among members of the association.

The Evans Friction Cone Company, of Boston, through Mr. Conant and Mr. Burbank, distributed some very fine catalogues with blue prints of installations using the Evans system, at Leavenworth, Kan., Altoona, Pa., and Waltham, Mass. These prints were very nicely made, and were appreciated by the members who were interested in the system.

Mr. Elmer Willyoung represented the firm of James W. Queen & Co., of Philadelphia, and had a very fine exhibit of the company's accurate measuring instruments in one of the rooms on the first floor of the Stockton. A portable photometer and some very carefully adjusted resistance boxes, voltmeters and ammeters were prominent features of this excellent display.

The Standard Carbon Company was represented by Mr. J. B. Crouse, who says that his company sold 21,000,000 carbons last year, and that its factory now has a capacity of 2,000,000 per month. Mr. Dangler has sold his interest in the company to Mr. Crouse, Mr. W. G. Smith and Mr. H. A. Tremaine, and these three gentlemen now hold the entire stock of the concern.

The Electrical Supply Company, of Chicago, Ill., and Ansonia, Conn., was well represented at the Stockton by Mr. Chas. Wirt and Mr. F. B. Platt. These gentlemen distributed some very fine catalogues of the company's goods, and gave a large amount of information to inquirers concerning their excellent incandescent lamp hanger and the Wirt lightning arrester.

The United Electric Equipment Company, of Philadelphia, had an exhibit of the Wenstrom motors and dynamos, of automatic fire alarms, electric gong bells, registers, watchmen's clocks, etc., at the lower end of the main corridor. The exhibit was neatly arranged and attracted much attention. Some very nice printed matter was distributed to members and their friends.

The Crocker-Wheeler Motor Company had an interesting display of its well known machines in the various standard sizes. One of them was shown coupled to a Gould triplex pump, making a neat combination for domestic pumping service. The whole exhibit is a credit to the company and while the motor needs no introduction to the electrical

fraternity it always attracts attention. The company was represented at the convention by Mr. T. McCoubray.

The Washburn & Moen Company was represented at the convention by Mr. H. M. Smith. The company had a striking collection of soft and hard drawn copper wire on exhibition. The great shining coils of copper attracted much attention and formed a very instructive exhibit. One small coil of No. 38 contained over 8 miles of wire in a single piece. With the bare wire is shown a line of electric light conductor, insulated by the Western Electric Company.

Mr. Nathan Bushnell, well known as the New York representative of the Eureka Tempered Copper Company, intended to be present at the convention meetings, but was detained by the death of his brother, Ives Bushnell, by drowning in Long Island Sound. The accident occurred near New Haven, Conn., nearly two weeks ago, but the body was not found until Sunday of last week, when it was discovered at Green Point, L. I., 60 or 70 miles from the scene of the accident.

The little bulletins, containing a programme of the meetings, a synopsis of what was done at preceding sessions, the names of the delegates present, and other matters of timely interest, issued and distributed free by THE ELECTRICAL WORLD, as its contribution to the success of the convention, have for years been a useful and pleasant feature of these occasions. Many were good enough to say that the Cape May bulletins were even more complete and satisfactory than their predecessors, which was exceedingly gratifying, and will have the effect of encouraging a still further effort towards improvement in the bulletin at coming conventions.

The Interior Conduit and Insulation Company had a very elaborate and interesting exhibit of its conduit tubing and accessory apparatus for a complete installation of interior wiring. Various styles of finish of the tubing were shown together with the methods which may be used in its installation. The exhibit was visited by hundreds of Cape May people who were seeking information upon methods of safe interior wiring for electric plants. All callers were supplied with a neat little pamphlet containing fac-simile letters of recommendation of the system from such men as Thomas A. Edison, Elihu Thomson and others. Mr. E. H. Johnson and Mr. E. W. Little represented the company at the convention.

Some Leaders of the Association.

On another page we present a group of portraits of eleven of the leading members of the National Electric Light Association. Though these gentlemen are all well known to the electrical fraternity, it is well to recall their positions and services in the advancement of electric lighting.

They have all been prominent in the deliberations of various conventions, and more than one of them is known to electrical experts as a skilled engineer. Nearly all of them are practical central station men, familiar with the details of electric lighting since the early days of the art. Those who have followed the proceedings of past conventions will be familiar enough with their names, and it is a pleasure to make their faces known to every reader of THE ELECTRICAL WORLD.

President Perry was born in Rehoboth, Mass., in 1849. He was one of the pioneers in the field, and in 1883 obtained a controlling interest in the electric lighting of Fall River, Mass., and Providence, R. I., and he is now an officer in the companies of both cities.

John A. Seely is head of the Seely & Taylor Manufacturing Company, of No. 24 Cortlandt street, New York.

James English is an officer in many companies, but is most actively connected with the New Haven Electric Company.

C. H. Wilmerding comes from Chicago, where he repreents the Chicago Arc Light and Power Company.

s M. J. Francisco manages the lighting of Rutland, Vt., and is influencing the illumination of many other towns, especially through their common councils.

Dr. A. F. Mason, of the Simplex Electric Company, is a constitutional lawyer as well as an electrical expert.

E. R. Weeks, formerly president of the Association, is general manager of several electrical concerns in Kansas City, including the Kansas City Electric Light Company and the Edison and Sperry companies.

C. R. Huntley is the secretary and general manager of the Buffalo Electric Light Company.

E. A. Maher is from Albany, where he is prominent in both the electrical and the political world.

Jos. E. Lockwood is at the head of the well-known Lockwood Instrument Company, of Detroit, Mich.

Allen R. Foote is, as everybody knows, the head of the electrical department of the Census Bureau, and the very efficient secretary of the association.

The Clambake of the Year.

The twelfth annual clambake tendered to the electrical fraternity by the American Electrical Works, of Providence, R. I., took place on Saturday, Aug. 23, at Vue de l'Eau Club, on the Providence River, and, as was to be expected, was a grand success. The attendance was unusually large.

Promptly at 10 A. M. the fortunate ones who had assembled at the Rhode Island Telephone Exchange marched to the steamboat wharf, where the "Continental" special boat was awaiting them. After a pleasant sail down the river the party landed at the Vue de l'Eau Club, Silver Spring, where football, baseball and other athletic sports were indulged in. Boston came off victorious in the baseball game. Father McGlynn won the honors in the football game, although his hat is not in as good a condition as before the game. A. V. Garratt won all the money on the rifle shooting, as he had the pull on the gun and worked the target.

At three o'clock the guests sat down to the especially prepared "bake," every member being presented with a "squawkophone," the discovery of which valuable musical instrument was announced to be the result of recent explorations in the darkest Africa. Mr. Geo. S. Bowen, recently of Elgin, Ill., in a short and pithy speech, welcomed the guests in the name of the company. Immediately after dinner, Gen. O. E. Madden, of New York, the toastmaster, in a witty manner related the history of the last eleven gatherings.

In response to the toast, "Eugene S. Phillips, Everybody's Host and Friend," Mr. Phillips made a neat and appropriate speech. "The Rhode Island Clam Bake" was responded to by Mr. I. N. Addeman, Secretary of State for Rhode Island. Other toasts were responded to by Sewell Smith, H. L. Storke, M. J. Perry, P. H. Alexander, T. C. Martin, "Happy" Adams, Frank Ridlon and W. J. Denver. Letters of regret were read from M. M. M. Slattery, J. A. Taylor, G. M. Phelps, G. D. Scott and others.

At five o'clock the party broke up with three cheers for the American Electrical Works and its officials, Messrs. Phillips and Sawyer. Providence was reached about six o'clock, and the members departed for home. A large number, however, at the invitation of President Perry, repaired to the station of the Narragansett Electric Light Company, where the well-arranged machinery and other apparatus was the subject of much favorable comment. THE ELECTRICAL WORLD representatives, as well as other visiting delegates, desire to express their thanks to Mr. P. C. Ackerman, who did all in his power to make the trip from New York an enjoyable one. The Reception Committee was composed of the following gentlemen: Marsden J. Perry, Providence; John I. Sabin, San Francisco; J. J. Carty, New York; E. B. Baker, New Haven; Henry B. Cram, Boston, and W. H. Sawyer, Providence. Among those present were the following:

BOSTON.—E. D. Floyd, H. B. Cram, J. R. McGee, C. B. Burleigh, F. S. Bertwhistle, C. H. Herrick, C. B. Price, A. C. Shaw, A. V. Garratt, L. H. Hart, J. R. Butler, R. F. Ross, W. S. Key, P. Fahey, C. H. Churchill, A. A. Zeigler, Frank Ridlon, E. O. Maddon, W. J. Denver, F. E. Pettingell, M. W. Turner, F. W. Crocker, W. C Woodward. Levi Cofren, D. A. Harrington, G. W. Blodgett, A. D. Blodgett, W.S. Hill, F. M. Ferrin, L. E. Hill, N. W. Lillie, F. E. French, F. M. Kimball, Chas. Burgher, L. F. Jordan, F. A. Hanaford, M. S. Lewis, C. E. Bibber, J. H. Cramplearce, Sewell Smith, J. A. McCoy, A. H. Chapman, Geo. W. Adams, J. C. Wilson, J. S. Lynch, C. L. Bly, J. R. Lovejoy, J. L. Lucas, G. B. Neale. J. H. Clark, F. E. Smith, P. C. Nason, F. A. Swan, W. R. Bogart, W. G. Benedict, E. C. Perkins, F. J. Swain.

NEW YORK.—W. C. Sellers, P. C. Ackerman, C. E. Stump, P. H. Alexander, F. W. Harrington, J. A. Drew, J. J. Carty, H. L. Storke, H.A. Storrs, B. F. Hamilton, F. J.Hovey, T. C. Martin C. W. Price.

PROVIDENCE, R. I.—W. H. Thurston, Edwin A. Smith, E. M. Carhart, V.A. Thomas, A. P. Crowley, O. J. Hoff, Geo. H. Thurston, J. O. Darling, J. I. Drake, S. R. Payson, C. H. Harris, G. H. Darling, R. H. Whittier, H. H. Sherman, Eugene F. Phillips, W. A. Hathaway, C. H. Wagenseil, E. W. Fyler, W. D. Warren, F. C. Haist, A. L. Capper, E. R. Phillips, C. R. Remington, Jr., G. C. Sims, W. H. Sawyer, G. A. Steer, W. I. Thurston, A. C. White, H. C. Bradford, W. N. Munro, W. W. Dempster, I. N. Addeman, M. J. Perry, J. W. MacDonald, Isaac Kirby, F. G. Longee.

WORCESTER, MASS.—Wm. Brophy, G. W. Barnes, F. H. Brophy, H. S. Spaulding.

PAWTUCKET, R. I.—E. A. Perrin, D. L. Fales, J. H. Andrew, J. E. Andrew, N. B. Dennison.

WOONSOCKET, R. I.—J. H. Cary.

WARWICK, R. I.—C. W. Baker.

NORTH ATTLEBORO, MASS.—J. E. Draper, L. W. Dillon.

ATTLEBORO, MASS.—G. B. Murch, N. J. Sweet.

LYNN, MASS.—A. L. Bohrer, L. J. Runker, I. F. Baker.

HOPEDALE, MASS.—A. T. Gifford.

FRANKLIN, MASS.—A. H. Morse.

FALL RIVER, MASS.—A. F. Dowd, Wm. S. Whitney, Chas. Sylvester.

SPRINGFIELD, MASS.—Geo. Fuller, F. G. Daboll, W. H. French.

NEW BEDFORD, MASS.—R. S. Taber, W. R. Sherman, W. K.Wagner.

LOWELL, MASS.—L. A. Derby, C. A. Grant.

GARDNER, MASS.—E. F. Carpenter.

TAUNTON, MASS.—Abner Coleman.

COHASSET, MASS.—L. T. Cushing.

NEW HAVEN, CONN.—E. N. Clark, E. B. Baker.

HARTFORD, CONN.—D. P. Colton, H. H. Johnson, J. J. Gates, C. G. Perkins, W. H. Babcock.

NORWICH, CONN.—G. W. Phillips, J. Pickford.

MANCHESTER, CONN.—N. T. Pulsifer.

NEWARK, N. J.—G. A. Tobey, E. F. Small.

WATERBURY, CONN.—A. M. Young, A. O. Shepardson.

NEW BRITAIN, CONN.—L. C Whitney.

CATSKILL, N. Y.—Fred. Werner.

BROOKLYN, N. Y.—W. T. Hunt, F. C. Mason.

MONTREAL, QUE.—John Carroll, L. B. McFarlane, A. J. Corriveau.

CHICAGO, ILL.—H. H. Small.

BIRMINGHAM, CONN.—S. W. Ives.

KANSAS CITY, MO.—Albert Phenis.

FARMERSVILLE, OHIO.—J. F. Rohrer.

TORONTO, ONT.—W. J. Morrison, D. C. Washington, F. W, Royce

ELGIN, ILL.—Geo. S. Bowen.

ELIZABETH, N. J.—Harry Stewart, R. Stewart.

Moonlight Tables for September.

Herewith we give Mr. H. W. Frund's table of lighting hours for the month of September, under his modified form of moon schedule. A few correspondents have asked us whether the time is solar. The answer is, of course affirmative.

Schedule for September, 1890.

TABLE NO. 1. Standard Moonlight Philadelphia System.				TABLE NO. 2. Frund's New Moonlight System.			
Date.	Light.	Date.	Extinguish	Date.	Light.	Date.	Exting.
1	7:00 P.M.	1	9:20 P.M.	1	7:00 P.M.	1	12:00 M.
2	7:00	2	9:50	2	7:00	2	12:0,
3	7:00	3	10:20	3	7:00	3	12:00
4	7:00	4	10:50	4	7:00	4	12:00
5	7:00	5	11:30	5	7:00	5	12:00
6	7:00	7	12:10 A.M.	6	7:00	7	12:10 A.M.
7	6:45	8	12:55	7	6:45	8	12:55
8	6:45	9	1:50	8	6:45	9	1:50
9	6:45	10	2:45	9	6:45	10	2:45
10	6:46	11	3:45	10	6:45	11	3:45
11	6:45	12	4:40	11	6;45	12	4:40
12	6:45	13	4:40	12	6:45	13	4:40
13	6:45	14	4:45	13	6:4,	14	4:45
14	6:35	15	4:45	14	6:35	15	4:45
15	6:35	16	4:45	15	6:35	16	4:45
16	6:35	17	4:45	16	6:35	17	4:45
17	6:35	18	4:45	17	6:35	18	4:45
18	6:35	19	4:45	18	6:35	19	4:45
19	8:05	20	4:45	19	6:35	20	4:45
20	8:45	21	4:50	20	6:35	21	4:50
21	9:35	22	4:50	21	6:25	22	4:50
22	10:35	23	4:50	22	6:25	23	4:50
23	11:40	24	4:50	23	6:25	24	4:50
24				24	6:25	24	12:00 M.
25	12:55 A.M.	25	4:50	25	12:55 A.M.	25	4:50 A. M.
26	2:10	26	4:50	25	6:25 P.M.	25	12:00 M.
27	No light.	27	No light	26	6:25	26	12:00
28	No light.	28	No light.	27	6:25	27	12:00
29	No light.	29	No light.	28	6:15	28	12:00
30	6:15 P.M.	30	8:15 P.M.	29	6:15	29	12:00
				30	6:15	30	12:00
Total hours lighting 176.55.				Total hours lighting 236.15.			

The Electro-magnet.*

BY PROF. SILVANUS P. THOMPSON, D.SC., B.A., M.I.E.E.

INTRODUCTION.

Among the great inventions which have originated in the lecture room of the Society of Arts in which we are met are two of special interest to electricians—the application of gutta percha to the purpose of submarine cables, and the electro-magnet. This latter invention was first publicly described, from the very platform on which I stand, on May 23, 1825, by William Sturgeon, whose paper is to be found in the volume of the Transactions of the Society of Arts for that year. For this invention we may rightfully claim the very highest place. Electrical engineering, the latest and most vigorous offshoot of applied sciences, embraces many branches. The dynamo for generating electric currents, the motor for transforming their energy back into work, the arc lamp, the electric bell, the telephone, the recent electro-magnetic machinery for coal mining, for the separation of ore, and many other electro-mechanical contrivances, come within the purview of the electrical engineer. In every one of these, and in many more of the useful applications of electricity, the central organ is an electro-magnet. By means of this simple and familiar contrivance—an iron core surrounded by a copper wire coil—mechanical actions are produced at will, at a distance, under control, by the agency of electric currents. These mechanical actions are known to vary with the mass, form and quality of the iron core, the quantity and disposition of the copper wire wound upon it, the quantity of electric current circulating around it, the form, quality, and distance of the iron armature upon which it acts. But the laws which govern the mechanical action in relation to these various matters are by no means well known, and, indeed, several of them have long been a matter of dispute. Gradually, however, that which has been vague and indeterminate becomes clear and precise. The laws of the steady circulation of electric currents, at one time altogether obscure, were cleared up by the discovery of the famous law of Ohm. Their extension to the case of rapidly interrupted currents, such as are used in telegraphic working, was discovered by Helmholtz; while to Maxwell is due their future extension to alternating, or, as they are sometimes called, undulatory currents. All this was purely electric work. But the law of the electro-magnet was still undiscovered; the magnetic part of the problem was still buried in obscurity. The only exact reasoning about magnetism dealt with problems of another kind; it was couched in language of a misleading character; for the practical problems connected with the electro-magnet it was worse than useless. The doctrine of two magnetic fluids distributed over the end surfaces of magnets, which under the sanction of the great names of Coulomb, of Poisson, and of Laplace, had unfortunately become recognized as an accepted part of science along with the law of inverse squares. How greatly the progress of electro-magnetic science has been impeded and retarded by the weight of these great names it is impossible now to gauge. We now know that for all purposes, save only those whose value lies in the domain of abstract mathematics, the doctrine of the two magnetic fluids is false and misleading. We know that magnetism, so far from residing on the end or surface of the magnet, is a property resident throughout the mass; that the internal not the external magnetization is the important fact to be considered; that the so-called free magnetism on the surface is, as it were, an accidental phenomenon; that the magnet is really most highly magnetized at those parts where there is least surface magnetization; finally, that the doctrine of surface distribution of fluids is absolutely incompetent to afford a basis of calculation such as is required by the electrical engineer. He requires rules to enable him not only to predict the lifting power of a given electro-magnet, but also to guide him in designing and constructing electro-magnets of special forms suitable for the various cases that arise in his practice. He wants in one place a strong electromagnet to hold on to its armature like a limpet to its native rock; in another case he desires a magnet having a very long range of attraction, and wants a rule to guide him to the best design; in another he wants a special form having the most rapid action attainable; in yet another he must sacrifice everything else to attain maximum action with minimum weight. Toward the solution of such practical problems as these the old theory of magnetism offered not the slightest aid. Its array of mathematical symbols was a mockery. It was as though an engineer asking for rules to enable him to design the cylinder and piston of an engine were confronted with receipts how to estimate the cost of painting it.

Gradually, however, new light dawned. It became customary, in spite of the mathematicians, to regard the magnetism of a magnet as something that traverses or circulates around a definite path, flowing more freely through such substances as iron than through other relatively non-magnetic materials. Analogies between the flow of electricity in an electrically conducting circuit, and the passage of magnetic lines of force through circuits possessing magnetic conductivity, forced themselves upon the minds of experimenters, and compelled a mode of thought quite other than the previously accepted. So

* Cantor Lectures, No. 1.

far back as 1821, Cumming* experimenting on magnetic conductivity. The idea of a magnetic circuit was more or less familiar to Ritchie,† Sturgeon,‡ Dove,§ Dub,‖ and De La Rive,¶ the last-named of whom explicitly uses the phrase, "a closed magnetic circuit." Joule** found the maximum power of an electro-magnet to be proportional to "the least sectional area of the entire magnetic circuit," and he considered the resistance to induction as proportional to the length of the magnetic circuit. Indeed, there are to be found scattered in Joule's writings on the subject of magnetism, some five or six sentences, which, if collected together, constitute a very full statement of the whole matter. Faraday,†† considered that he had proved that each magnetic line of force constitutes a closed curve; that the path of these closed curves depended on the magnetic conductivity of the masses disposed in proximity; that the lines of magnetic force were strictly analogous to the lines of electric flow in an electric circuit. He spoke of a magnet surrounded by air being like unto a voltaic battery immersed in water or other electrolyte. He even saw the existence of a power, analogous to that of electromotive-force in electric circuits, though the name, "magneto-motive force," is of more recent origin. The notion of magnetic conductivity is to be found in Maxwell's great treatise (vol. ii., p. 51), but is only briefly mentioned. Rowland,‡‡ in 1873, expressly adopted the reasoning and language of Faraday's method n the working out of some new results on magnetic permeability, and pointed out that the flow of magnetic lines of force through a bar could be subjected to exact calculation; the elementary law, he says, "is similar to the aw of Ohm." According to Rowland, the "magnetizing force of helix" was to be divided by the "resistance to the ines of force;" a calculation for magnetic circuits which every electrician will recognize as precisely as Ohm's law for electric circuits. He applied the calculations to determine the permeability of certain specimens of iron, steel, and nickel. In 1882,§§ and again in 1883, Mr. R. H. M. Bosanquet‖‖ brought out at greater length a similar argument, employing the extremely apt term "Magneto-motive Force," to connote the force tending to drive the magnetic line of induction through the "magnetic resistance" or, as it will frequently be called in these lectures the magnetic "reluctance," of the circuit. In these papers the calculations are reduced to a system, and deal not only with the specific properties of iron, but with problems arising out of the shape of the iron. Bosanquet shows how to calculate the several resistances (or reluctances) of the separate parts of the circuit, and then add them together to obtain the total resistance (or reluctance), of the magnetic circuit.

Prior to this, however, the principle of the magnetic circuit had been seized upon by Lord Elphinstone and Mr. Vincent, who proposed to apply it in the construction of the dynamo-electric machines. On two occasions ¶¶ they communicated to the Royal Society the results of experiments to show that the same exciting current would evoke a larger amount of magnetism in a given iron structure, if that iron structure formed a closed magnetic circuit than if it were otherwise disposed.

In recent years the notion of the magnetic circuit has been vigorously taken up by the designers of dynamo-machines, who, indeed, base the calculation of their designs upon this all-important principle. Having this, they need no laws of inverse squares of distances, no magnetic moments, none of the elaborate expressions for surface distribution of magnetism, none of the ancient paraphernalia of the last century. The simple law of the magnetic circuit, and a knowledge of the properties of iron is practically all they need. About four years ago, much was done by Mr. Gisbert Kapp*** and by Drs. J. and E. Hopkinson††† in the application of these considerations to the design of dynamo-machines, which previously had been a matter of empirical practice. To this end the formulæ of Professor Forbes‡‡‡ for calculating magnetic leakage, and the researches of Professors Ayrton and Perry§§§ on magnetic shunts, contributed a not unimportant share. As the result of the advances made at that time, the subject of dynamo design was reduced to an exact science.

It is the aim and object of the present course of lectures to show how the same considerations which have been applied with such great success to the subject of the design of dynamo-electric machines may be applied to the study of the electro-magnet. The theory and practice of the design and construction of electro-magnets will thus be placed, once for all, upon a rational basis. Definite rules will be laid down for the guidance of the constructor, directing him as to the proper dimensions and form of iron to be chosen, and as to the proper size and amount of copper wire to be wound upon it in order to produce any desired result.

First, however, a historical account of the invention will be given, followed by a number of general considerations respecting the uses and forms of electro-magnets. These will be followed by a discussion of the magnetic properties of iron and steel and other materials; some account being added of the methods used for determining the magnetic permeability of various brands of iron at different degrees of saturation. Tabular information is given as to the results found by different observers. In connection with the magnetic properties of iron the phenomenon of magnetic hysteresis is also described and discussed. The principle of

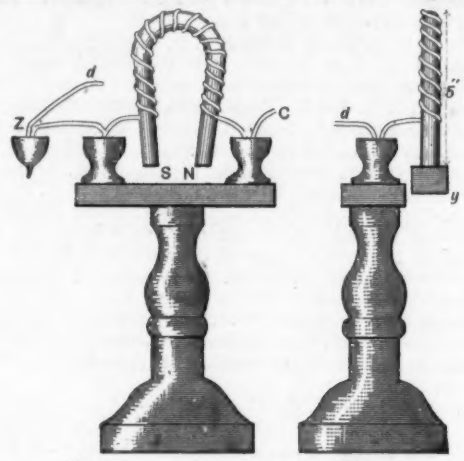


Fig. 1.

Fig. 2.

Sturgeon's First Electro-Magnet.

the magnetic circuit is then discussed with numerical examples, and a number of experimental data respecting the performance of electro-magnets are adduced, in particular those bearing upon the tractive power of electro-magnets. The law of traction between an electro-magnet and its armature is then laid down, followed by the rules for predetermining the iron cores and copper coils required to give any prescribed tractive force. Then comes the extension of the calculation of the magnetic circuit to those cases where there is an air gap between the poles of the magnet and the armature, and where, in consequence, there is leakage of the magnetic lines from pole to pole. The rules for calculating the winding of the copper coils are stated, and the limiting relation between the magnetizing power of the coil and the heating effect of the current in it is explained. After this comes a detailed discussion of the special varieties of form that must be given to electro-magnets in order to adapt them to special services. Those which are designed for maximum traction, for quickest action, for longest range, for greatest economy when used in continuous daily service, for working in series with constant current, for use in parallel at constant pressure and those for use with alternate currents are separately considered.

Lastly, some account is given of the various forms of electro-magnetic mechanism which have arisen in connection with the invention of the electro-magnet. The plunger and coil is specially considered as constituting a species of electromagnet adapted for a long range of motion. Modes of mechanically securing long range for electro-magnets, and of equalizing their pull over the range of motion of the armature, are also described. The analogies between sundry electro-mechanical movements and the corresponding pieces of ordinary mechanism are traced out. The course is concluded by a consideration of the

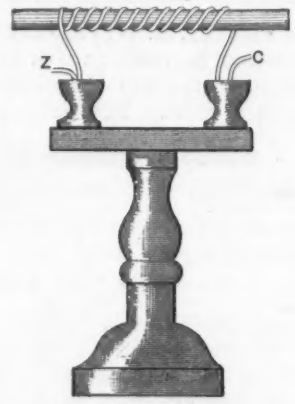


Fig. 3.

Sturgeon's Straight Bar Electro-Magnet.

various modes of preventing or minimizing the sparks which occur in the circuits in which electro-magnets are used.

HISTORICAL SK ETCH.

The effect which an electric current, flowing in a wire, can exercise upon a neighboring compass needle was discovered by Oersted in 1820.* The first announcement of the possession of magnetic properties by an electric current was followed speedily by the researches of Ampère,† Arago,‡ Davy,§ and by the devices of several other experimenters, including De La Rive's‖ floating battery and coil; Schweigger's¶ multiplier, Cumming's** galvanometer, Faraday's* apparatus for rotation of a permanent magnet, Marsh's† vibrating pendulum, and Barlow's‡ rotating star-wheel. But it was not until 1825 that the electro-magnet was invented. Davy had, indeed, in 1821, surrounded with temporary coils of wire the steel needles upon which he was experimenting, and had shown that the flow of electricity around the coil could confer magnetic power upon the steel needles. But from this experiment it was a grand step forward to the discovery that a core of soft iron, surrounded by its own appropriate coil of copper, could be made to act not only as a powerful magnet, but as a magnet whose power could be turned on or off at will, could be augmented to any desired degree, and could be set into action and controlled from a practically unlimited distance.

The electro-magnet, in the form which can first claim recognition for these qualities, was devised by William Sturgeon,§ and is described by him in the paper which he contributed to the proceedings of the Society of Arts in 1825, accompanying a set of improved apparatus for electro-magnetic experiments.‖ The Society of Arts rewarded Sturgeon's labors by awarding him the silver medal of the Society and a premium of 30 guineas. Amongst this set of apparatus are two electro-magnets, one of horse shoe shape (Fig. 1 and 2) and one a straight bar (Fig. 3). It will be seen that the former figures represent an electro-magnet consisting of a bent iron rod about one foot long and a half inch in diameter, varnished over and then coiled with a single left-handed spiral of stout uncovered copper wire of 18 coils. This coil was found appropriate to the particular battery which Sturgeon preferred, namely, a single cell containing a spirally enrolled pair of zinc and copper plates of large area (about 130 square inches) immersed in acid, which cell, having small internal resistance, would yield a large quantity of current when connected to a circuit of small resistance. The ends of the copper wire were brought out sideways and bent down so as to dip into two deep connecting cups marked *Z* and *C*, fixed upon a wooden stand. These cups, which were of wood, served as supports to hold up the electro-magnet, and having mercury in them served also to make good electrical connection. In Fig. 2, the magnet is seen sideways, supporting a bar of iron, *y*. The circuit was completed to the battery through a connecting wire, *d*, which could be lifted out of the cup, *z*, so breaking circuit when desired, and allowing the weight to drop. Sturgeon added in his explanatory remarks that the poles, *N* and *S*, of the magnet will be reversed if you wrap the copper wire about the rod as a right-handed screw, instead of a left-handed one, or, more simply, by reversing the connections with the battery, by causing the wire that dips into the *Z* cup to dip into the *C* cup, and *vice versa*. This electro-magnet was capable of supporting 9 pounds when thus excited.

Fig. 3 shows another arrangement to fit on the same stand. "This arrangement communicates magnetism to hardened steel bars, as soon as they are put in, and renders soft iron within it magnetic during the time of action; it only differs from Figs. 1 and 2 in being straight, and thereby allows the steel or iron bars to slide in and out.

For this piece of apparatus and other adjuncts accompanying it, all of which are described in the Society's "Transactions" for 1825, Sturgeon was awarded the Society's silver medal and a premium of thirty guineas. The apparatus was deposited in the museum of the Society, which therefore might be supposed to be the proud possessor of the first electro-magnet ever constructed. Alas for the vanity of human affairs, the Society's museum of apparatus has long been dispersed, this priceless relic having been either made over to the now defunct Patent-office Museum, or knocked down under the hammer of the auctioneer for a few paltry halfpence.

Sturgeon's first electro-magnet, the core of which weighing about 7 ounces, was able to sustain a load of 9 pounds, or about 20 times its own weight. At the time it was considered a truly remarkable performance. Its single layer of stout copper wire was well adapted to the battery employed, a single cell of Sturgeon's own particular construction having a surface of 130 square inches, and therefore of small internal resistance. Subsequently in the hands of Joule, the same electro-magnet sustained a load of 50 pounds, or about 114 times its own weight. Writing in 1832 about his apparatus of 1825, Sturgeon used the following magniloquent language:

"When first I showed that the magnetic energies of a

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* "Camb. Phil. Trans.," April 2, 1821.
† "Phil. Mag.," series iii., vol. iii., p. 122.
‡ "Ann. of Electr.," xii., p. 217.
§ "Pogg. Ann.," xxix., p. 462, 1833. See also "Pogg. Ann.," xliii., p. 517, 1838.
‖ "Dub. Elektromagnetismus" (ed. 1861), p. 401; and "Pogg. Ann.," xc., p. 440, 1853.
¶ De La Rive. "Treatise on Electricity" (Walker's translation), vol. i., p. 292.
** "Ann. of Electr.," iv., 59, 1839; v., 195, 1841; and "Scientific Papers," pp. 8, 34, 35, 36.
†† "Experimental Researches," vol. iii., art. 3117, 3228, 3230, 3260, 3271, 3276, 3294, and 3361.
‡‡ Phil. Mag., series iv., vol. xlvi., August 1873, "On Magnetic Permeability and the Maximum of Magnetism of Iron, Steel, and Nickel."
§§ "Proc. Royal Soc.," xxxiv., p. 445, December, 1882.
‖‖ "Phil. Mag.," series v., vol xv., p. 205, March, 1883, "On Magneto-Motive Force." Also *ib.*, vol. xix., February, 1885, and "Proc. Roy. Soc.," No. 223, 1883. See also "Electrician," xiv., p. 291, February 14, 1885.
¶¶ "Proc. Roy. Soc.," xxix., p. 299, 1879, and xxx., p. 287, 1880. See "Electrical Review," viii., p. 134, 1880.
*** The Electrical World, June 11, 1887; also "Proc Inst. Civil Engineers," lxxxiii., 1885-6; and "Jour. Soc. Telegr. Engineers," xv., 524, 1886.
††† "Phil. Trans.," 1886, pt. i., p. 331; and "The Electrician," xviii., pp. 39, 63, 86. 1886.
‡‡‡ "Journ. Soc. Telegr. Engineers," xv., 555. 1886. The Electrical World, July 16, 1887.
§§§ "Journ. Soc. Telegr. Engineers," xv., 530, 1886.

* See Thomson's "Annals of Philosophy," Oct., 1820.
† *Ann. de Chim. et de Physique*, xv., 59 and 170, 1820.
‡ *Ib.*, xv., 93, 1820.
§ *Phil Trans.*, 1821.
‖ "Bibliothèque Universelle," March, 1821.
¶ *Ib.*
** *Camb. Phil. Trans.*, 1821.

* "Quarterly Journal of Science," Sept., 1821.
† Barlow's "Magnetic Attractions," second edition, 1823.
‡ *Ib.*
§ William Sturgeon, the inventor of the electro-magnet, was born at Whittington, in Lancashire, in 1783. Apprenticed as a boy to the trade of a shoemaker, at the age of 19 he joined the Westmoreland militia, and two years later enlisted into the Royal Artillery, thus gaining the chance of learning something of science, and having leisure in which to pursue his absorbing passion for chemical and physical experiments. He was 42 years of age when he made his great, though at the time unrecognized, invention. At the date of his researches in electro-magnetism he was resident at 8 Artillery place, Woolwich, at which place he was the associate of Marsh and was intimate with Barlow. Christie, and Gregory, who interested themselves in his work. In 1835 he presented a paper to the Royal Society containing descriptions, *inter alia*, of a magneto-electric machine with longitudinally wound armature, and with a commutator consisting of half discs of metal. For some reason this paper was not admitted to the "Philosophical Transactions;" he afterwards printed it in full, without alteration, in his volume of Scientific Researches, published by subscription in 1850. From 1836 to 1843 he conducted the "Annals of Electricity." He had now removed to Manchester, where he lectured on electricity at the Royal Victoria Gallery. He died at Prestwick, near Manchester, in 1850. There is a tablet to his memory in the church at Kirkby Lonsdale, from which town the village of Whittington is distant about two miles. A portrait of Sturgeon in oils, and said to be an excellent likeness, is believed still to be in existence; but all inquiries as to its whereabouts have proved unavailing. At the present moment, so far as I am aware, the scientific world is absolutely without a portrait of the inventor of the electro-magnet.
‖ "Trans. Society of Arts," 1825, xliii., p. 38.

galvanic conducting wire are more conspicuously exhibited by exercising them on soft iron than on hard steel, my experiments were limited to small masses—generally to a few inches of rod iron about half an inch in diameter. Some of those pieces were employed while straight, and others were bent into the form of a horse-shoe magnet, each piece being encompassed by a spiral conductor of copper wire. The magnetic energies developed by these simple arrangements are of a very distinguished and exalted character, as is conspicuously manifested by the suspension of a considerable weight at the poles during the period of excitation by the electric influence.

"An unparalleled transiliency of magnetic action is also displayed in soft iron by an instantaneous transition from a state of total inactivity to that of vigorous polarity, and also by a simultaneous reciprocity of polarity in the extremities of the bar—versatilities in this branch of physics for the display of which soft iron is pre-eminently qualified, and which, by the agency of electricity, become demonstrable with the celerity of thought, and illustrated by experiments the most splendid in magnetics. It is, moreover, abundantly manifested by ample experiments, that galvanic electricity exercises a superlative degree of excitation on the latent magnetism of soft iron, and calls for its recondite powers with astonishing promptitude, to an intensity of action far surpassing anything which can be accomplished by any known application of the most vigorous permanent magnet, or by any other mode of experimenting hitherto discovered. It has been observed, however, by experimenting on different pieces selected from various sources, that. notwithstanding the greatest care be observed in preparing them of a uniform figure and dimensions, there appears a considerable difference in the susceptibility which they individually possess of developing the magnet powers, much of which depends upon the manner of treatment at the forge, as well as upon the natural character of the iron itself.*

"The superlative intensity of electro-magnets, and the facility and promptitude with which their energies can be brought into play, are qualifications admirably adapted for their introduction into a variety of arrangements in which powerful magnets so essentially operate and perform a distinguished part in the production of electro-magnetic rotations; whilst the versatilities of polarity of which they are susceptible are eminently calculated to give a pleasing diversity in the exhibition of that highly interesting class of phenomena, and lead to the production of others inimitable by any other means." †

Electrical Distribution by Transformers from Central and Eccentric Stations.‡

BY DR. J. A. FLEMING, M. A.

§ 5. *Transformer Station at Leghorn (Livorno).*—At Leghorn there is a central station in the Via Costanza, on the same general plan as that at Rome, for distribution of electric energy by means of transformers. The plant was constructed by Ganz, and the machines and regulating apparatus are similar in general design to that described in the foregoing sections. A general view of the machine room is given in Fig. 28. There are at present (1890) three combined engines and dynamos in position. The engines are direct-acting, high-pressure single-cylinder engines of 150 h. p., fitted with centrifugal spring governors, the governor wheels forming also the pulley by means of which the exciters are driven. These engines are coupled direct to Ganz alternators of the A type, similar in design to those at Rome. The alternators furnish at maximum load a current of 40 ampères at 2,000 volts, and are therefore 80 kilowatt machines. The dynamos are driven at a speed of 250 revolutions per minute. The armatures have 20 fixed bobbins, and the revolving field magnets 20 bobbins; hence the current has 5,000 alternations per minute, or 42 complete periods. The armature frame rests on a massive bed-plate, on which is also erected the engine; and the arrangement of the slotted bed-plate and screw before described renders it possible to traverse the armature away from the field magnet, and get at it for repairs. Both the field magnet cores and the armature coil cores are built up of laminated iron plates. There are three such steam dynamos placed side by side; they take steam from a battery of three Babcock and Wilcox water-tube boilers, each of a 150 h. p. size.

The exciters are driven off the governor wheel of each engine, and each furnish an exciting current of 25 ampères, at an E. M. F. of 100 volts.

The alternating current furnished by the dynamos is employed to feed about 2,000 incandescent lamps of 16 candle-power. From the station proceed two primary circuits, each consisting of a pair of insulated overhead copper conductors of 28 square millimetres in cross sectional area. The primary current supplies 17 transformers of 7.5 kilowatt size, four of 3.75 kilowatt size, and one of 1.875 kilowatt size, having their primary circuits arranged as usual in parallel between the primary mains. Although the station is not a large one, it is interesting from the fact that the alternators are worked in parallel on a single primary circuit as a regular thing. The two primary circuits start from a switchboard, which is exceedingly well arranged. The various connections on it are all made by highly insulated rubber-covered copper wire, carried on porcelain insulators, and the switches, cut-outs, etc., are all porcelain bases, and have porcelain handles or covers. At one side of the switchboard (see Fig. 28) is a bank of 1,320 incandescent lamps. The usual voltmeters, ampèremeters and regulators are conveniently placed. The automatic mercury cup resistance described in a previous section is also employed to maintain a constant potential at some point on the primary circuit, irrespective of the outgoing current. Each dynamo and engine can carry a load of about 1,200 16 c. p. lamps. When, therefore, the load on the external circuits does not

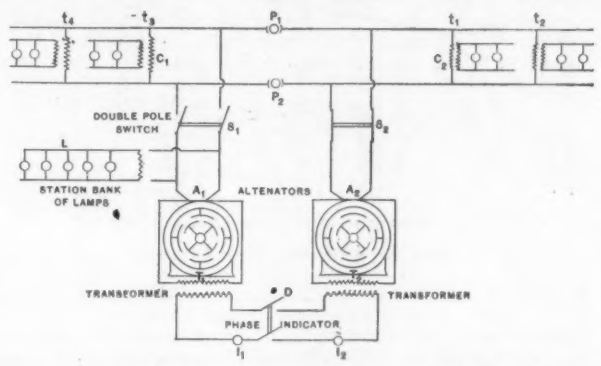


FIG. 29.—DIAGRAM REPRESENTING PHASE-INDICATING ARRANGEMENT FOR PUTTING ALTERNATORS IN PARALLEL ON ONE CIRCUIT.

exceed this, or is equivalent to about a primary current of 30 ampères, the two separate primary currents are worked as one circuit on one machine. After midnight, when the load generally falls to less than 300 lamps, it is taken over by a small auto-excited alternator, worked by a separate small engine. When, however, the demand exceeds 1,000—1,100 lamps, two of the larger machines are worked in parallel on to the two primary circuits joined into one. The method by which this parallel working of the alternators is practically carried out is very simple. Let C_1 and C_2 (Fig. 29) be the two separate primary circuits, which may be supposed to be joined into one circuit by the plugs P P_2. Let an alternator A_2 be supposed to be working on this single circuit, and that the time has come when a second alternator, A_1, has to be added in parallel with the first one to support the lamp load.

The first step is to run up the alternator A_1 to the proper speed and to set it to work on the station bank of lamps L and adjust its E. M. F. so that it has the same electromotive force and current output as the dynamo A_2, already on the circuit. From the poles of each alternator proceed leads to a pair of transformers T_1 T_2, whose secondaries are joined in series through a couple of incandescent lamps, l_1 l_2. On closing the double pole switch D the transformers T_1 and T_2 work together on the pair of lamps; and according as the alternators A_1 A_2 are in similar or in opposite phase as regards electromotive force, so are the lamps l_1 l_2 extinguished or alight. The moment when the lamps l_1 l_2 are both out the two machines A_1 A_2 are in step, although on different circuits. As the machines pass out of step the lamps l_1 l_2 pulsate in brightness, producing luminous "beats" as the current pulses catch each other up. At the instant when the indicating lamps are not visibly luminous the double pole switch S_1 is closed. The dynamo A_2 is then in parallel with A_1 on the circuit C_1 C_2; the load at lamps on L is then removed little by little, and the two alternators A_1 and A_2 are finally left working on one circuit. Similar arrangements allow all three dynamos to be put in parallel. At Leghorn it is found to be very easy to throw in one, two or three alternators in parallel as the lamp-load varies, and the machines keep each other in step perfectly when once they are put in parallel.

The station, as will seen from the view in Fig. 28, is a one-story building, and consists of two rooms, one the boiler house and the other the dynamo room. The station was opened in October, 1889, and has been in successful operation ever since. The station covers an area of about 45 feet by 100 feet, and the present building can accommodate one more 150 h. p. engine, boiler and dynamo, having, therefore, a capacity when full for three active dynamos and one reserve, or an effective output of 240 kilowatts, or 4,000 16 c. p. lamps in full use and for about 6,000 such lamps installed. This station is exceedingly well arranged, and as an example of alternators worked regularly in parallel is an interesting illustration of theory carried out into effective practice.

(To be continued.)

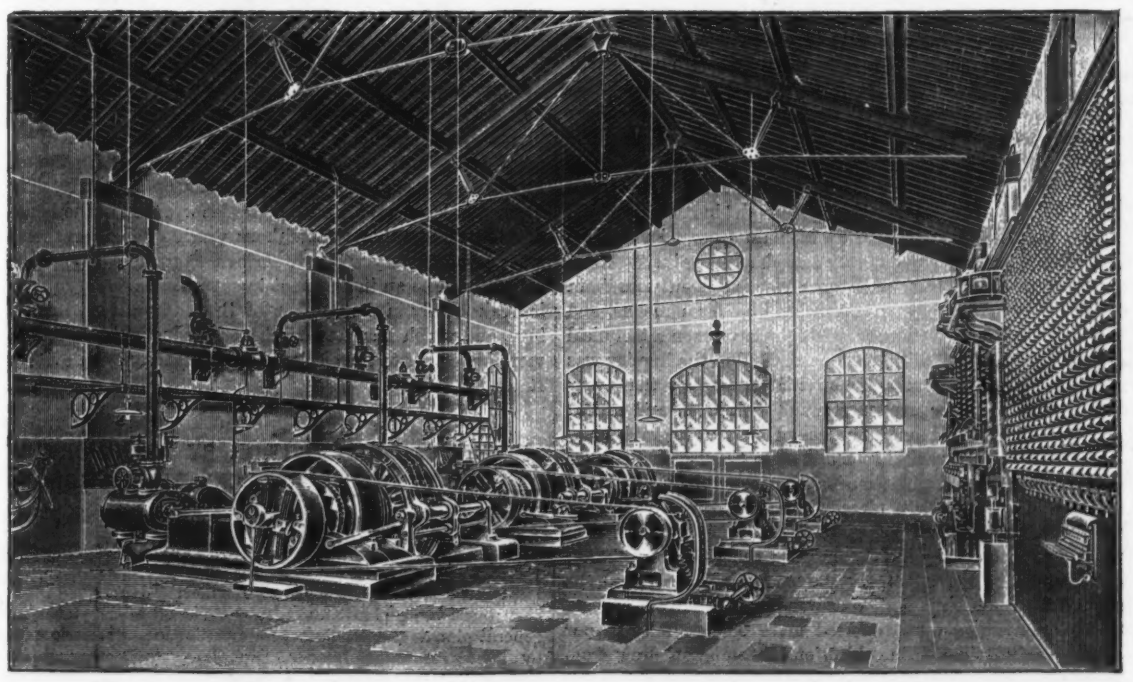


FIG. 28.—VIEW OF CENTRAL STATION, LEGHORN.

The Penobscot River Power.

The Bangor (Me.) *News* recently had this to say of the utilization of the splendid water-power of the Penobscot near Bangor: "Quietly, but systematically and energetically, a local company has been for some months engaged in the construction of a work which is destined to be of far-reaching benefit to this city and section, through the practical improvement of this undeveloped water-power. The result, when the limitless opportunities it opens up are fully considered, are in the nature of a surprise, but as the claims made in behalf of the new agent have been amply demonstrated in other localities, it would seem that a new era of prosperity for Bangor is at hand.

"Electricity is the agent by which the great river's energy is to be brought under subjection, and applied to the various forms of use which make up a thriving and prosperous industrial community. The Bangor Electric Light and Power Company have nearly completed, at Veazie, on the Penobscot, just above the city, at the cost of a third of a million dollars, a plant which has the distinction of being the largest water power electric plant in the world. Builded for the future, as well as for present demands, its capacity of 2,000 h. p. is capable of being doubled if needed, or in fact of being indefinitely extended. Power in large or small quantities, lights of greater or lesser intensity, in any number, are thus made available to the manufacturer and transporter of merchandise, the storekeeper, the small mechanic and the private citizen, at a comparatively small cost to the consumer.

"The general adoption of electric lighting, which is now become possible, will result in lighter, cooler, cleaner and safer workshops, stores and homes. The use of electric power distributed by wire to all parts of the city will bring about an industrial revolution. While capable of supplanting the more costly steam power for certain kinds of heavy work, its great field of usefulness is its capacity for supplanting handwork in small factories, printing offices, repair shops and households. In short, there is practically no use for which power is needed to which it cannot be made available.

"The announcement that the company are now ready to make contracts for supplying light and power in any quantities is cause for public congratulation. We shall expect to see a general introduction of the labor-saving agent, and a consequent marked increase of business in the small manufacturing establishments of which the city has so many, and we are much mistaken if the company are not flooded with correspondence from parties abroad, seeking a location for industries which are new to Bangor."

* "I have made a number of experiments on small pieces, from the results of which it appears that much hammering is highly detrimental to the development of magnetism in soft iron, whether the exciting cause be galvanic or any other. And, although good annealing is always essential, and facilitates to a considerable extent the display of polarity, that process is very far from restoring to the iron that degree of susceptibility which it frequently loses by the operation of the hammer. Cylindric rod iron of small dimensions may very easily be bent into the required form, without any hammering whatever; and I have found that small electro-magnets made in this way display the magnetic powers in a very exalted degree."

† Sturgeon's "Scientific Researches," p. 113.

‡ Continued from THE ELECTRICAL WORLD, Aug. 23, 1890.

The Working Efficiency of Secondary Cells.*

BY W. E. AYRTON; C. G. LAMB, E. W. SMITH, M. W. WOODS, Associates.

VIII.—CHEMICAL ACTION.

Dr. Frankland has shown that probably the discharge of an ordinary accumulator is accompanied by the formation of one or other, or both, of the new lead salts which he has isolated, and which have the formulæ ($Pb_2S_2O_{10}$) and ($Pb_2S_2O_{14}$) respectively. And he concludes that, in view of the great difficulty of electrolytically splitting up the well-known white sulphate of lead ($PbSO_4$), this sulphate is not formed in the ordinary discharge of the accumulator, and is only produced when the cell begins "to sulphate."†

Prof. W. Kohlrausch and C. Heim show in their paper already referred to that the observed variations in the specific gravity of the liquid during charge and discharge agree well with the very simple chemical actions—

Charge.

Positive plate—

$$PbSO_4 + 2\,H_2O + SO_4 = PbO_2 + 2\,H_2SO_4.$$

Negative plate—

$$PbSO_4 + H_2 = Pb + H_2SO_4.$$

Discharge.

Positive plate—

$$PbO_2 + H_2SO_4 + H_2 = PbSO_4 + 2\,H_2O.$$

Negative plate—

$$Pb + SO_4 = PbSO_4.$$

It is to be noticed, however, that the falling off in the specific gravity during discharge is merely a test of the amount of H_2SO_4 that is converted into H_2O, and affords no criterion as to what sulphate of lead is formed by the SO_3 liberated.

During our investigation we observed the variation in the specific gravity of the liquid during about 100 charges and discharges, and the mean of this large number of the fairly-consistent results that we obtained showed that, with the accumulators we were testing, the variation in density per ampère-hour was about 0.000232. This result is probably right to within 5 per cent., for our hydrometer would read accurately to about 0.0001, which is about 5 per cent. of 0.03, the total change in specific gravity observed during the discharge; and, therefore, as each result is correct to something like 5 per cent., the mean of a hundred results will certainly be correct to within 5 per cent.

On referring to tables of the density of dilute sulphuric acid, we find, by plotting the results, that between the limits we are concerned with—1.2 and 1.17—the change of density is directly proportional to the amount of SO_3 taken from the solution, and further, that to produce a change in density of 0.01 at 15° C., it requires that 1 gram of dilute sulphuric acid of density 1.2 should give up 0.01268 of a gram of SO_3. And as the liquid in each cell weighed about 10,490 grams when the cell was charged, and the density 1.2, it follows that the weight of SO_3 liberated per ampère-hour in each cell, when calculated from the variation in the specific gravity, must equal

$$\frac{0.000232}{0.01} \times 0.01268 \times 10{,}490 \text{ grams},$$

or 3.086 grams.

Further, the electro-chemical equivalent of SO_3 is 0.000414 grams per coulomb, and since lead sulphate is formed on both the positive and negative plates during the discharge, the weight of SO_3 taken out of the liquid per ampère-hour, when calculated from the electro-chemical equivalent of SO_3, must be

$$2 \times 3{,}600 \times 0.000414 = 3.041 \text{ grams}.$$

These two results show a close agreement. At the same time, it is to be noticed that not merely does the amount of SO_3 liberated per ampère hour come out somewhat higher when calculated from the *mean* change in the specific gravity than when calculated from the chemical equivalent, but the same result is obtained for each separate set of tests.

Mr. G. H. Robertson, working in Dr. Armstrong's laboratory, was so good as to analyze the sediment that fell to the bottom of the cells during the early part of the investigation, when in the discharges the P. D. was allowed to fall to 1.6 volts per cell.

The mixture was found to contain—

An indication of uncombined metallic lead,
A trace of antimony,

40.95 per cent. of combined lead	} *i. e.*, 47.3 per cent. of PbO_2		
6.35 " " oxygen			
34.63 " " lead	} *i. e.*, 50.74 " $PbSO_4$		
5.36 " " sulphur			
10.75 " " oxygen			
98.04			

so that 1.96 per cent. consisted of metallic lead, antimony and dirt.

The composition of the sediment showed a close approximation to PbO_2, $PbSO_4$, which consists of—

44.08 per cent. of PbO_2
55.92 " " $PbSO_4$

PbO_2, $PbSO_4$, in fact, contains—

76.33 per cent. of Pb
5.91 " " S
17.76 " " O

and the sediment contained---

75.58 per cent. of Pb
5.37 " " S
18.05 " " O

Dr. Frankland's salts may be represented as PbO_2 $2(PbSO_4)$ and $2(PbO)$ $3(PbSO_4)$ respectively, whereas the analysis of the deposit in our cells showed that it was certainly neither of these lead salts, but, instead, had almost the exact composition of PbO_2, $PbSO_4$.

In spite of accumulators with pasted plates having been in use now for nine years, the chemical action that takes place during the different stages of the charge and discharge has only been conjectured, and, odd, as it seems, no decisive experiment appears to have been made to settle this much-debated question. Various analyses have been made by different chemists of salts of lead acted on in certain ways with sulphuric acid, but apparently not of actual accumulator plates in action. We are therefore now, with the assistance of Mr. Robertson, making a complete investigation of the chemical state of the plugs of both the positive and negative plates at all stages of the charge and discharge of an 1888 E. P. S. type of accumulator in good condition. As this investigation, however, involves the chemical analysis of a large number of specimens, it will take some time yet to complete.

In order to observe what changes took place in the temperature of the cells during charge and discharge, the temperature of one of the cells under test was observed from time to time, as well as the temperature of the air and the temperature of an adjacent cell through which no current was being passed. The following temperature results, which were obtained during the steady discharges and charges after the first rest of 10 days (curves 10 and 11), are a sample of the observations taken. The discharge in each case commenced directly the P. D., in charging, had reached 2.4 volts per cell, and the charge in each case commenced directly the P. D., in discharging, had fallen to 1.8 volts per cell.

From the following table we see that, while during the charge the cell rises in temperature, during discharge, on the contrary, it actually falls; hence, in spite of the production of heat due to resistance, the cell is actually cooler at the end of a discharge than at the beginning—a result possibly due to the splitting up of the sulphuric acid during the discharge. This cooling of accumulators during discharge, which we noticed early in our experiments, was also observed at about the same by Professor Duncan and H. Wiegand in America and described in their joint investigation already referred to.

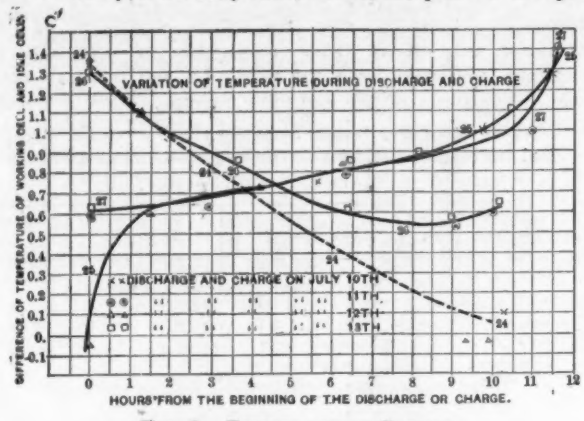

C'
VARIATION OF TEMPERATURE DURING DISCHARGE AND CHARGE
DIFFERENCE OF TEMPERATURE OF WORKING CELL AND IDLE CELL
× DISCHARGE AND CHARGE ON JULY 10TH
11TH.
12TH.
13TH.
HOURS FROM THE BEGINNING OF THE DISCHARGE OR CHARGE.

FIG. 8.—TEMPERATURE CURVES.

From the last table we see that the rise of temperature of the cell during charging may, after allowing for changes of temperature of the room, be either about 1.3 degrees C. or 0.77 degree C., while the fall of temperature during discharging may have either of the two preceding values. It is further interesting to notice that the rise of temperature during the charging has the higher or the lower of these two values according as the fall of temperature during the previous discharge had the higher or the lower value.

Date.	Time.		Cell under test. State.	Cell under test. Temp.	Temperature of Air.	Temperature of Idle cell.	Time from beginning of discharge or charge.		Difference between temperature of cell under test and temperature of idle cell.	Rise or fall of temperature during a complete discharge or charge, compared with temperature of idle cell.
1889.	Hrs.	min.		Degrees C.	Degrees C.	Degrees C.	Hrs.	min.	Degrees C.	
July 10.....	1	10	Charged.....	19.95	18.75	18.6	0	0	1.35	} — 1.25 during discharge.
"	11	20	Discharged.....	18.6	18.6	18.5	10	10	0.1	
"	16	55	Charging.....	19.6	19.1	18.84	5	35	0.76	
"	21	6	"	19.9	19.0	18.9	9	46	1.0	} + 1.2 " charge.
"	22	50	Charged.....	20.2	18.8	18.9	11	30	1.3	
July 11.....	7	55	Discharging.....	18.65	18.25	18.1	9	5	0.55	} — 0.70 " discharge.
"	8	50	Discharged.....	18.8	18.5	18.2	10	0	0.6	
"	11	38	Charging.....	19.05	18.6	18.4	2	48	0.65	
"	15	10	"	19.3	18.8	18.5	6	20	0.8	} + 0.77 " charge.
"	19	50	"	19.7	19.0	18.7	11	0	1.0	
"	20	25	Charged.....	20.1	19.0	18.73	11	35	1.37	
"	21	42	Discharging.....	19.95	18.95	18.85	1	22	1.10	
July 12.....	5	40	"	18.72	18 75	18.75	9	20	−0.03	} — 1.40 " discharge.
"	6	20	Discharged.....	18.72	18.75	18.75	9	55	− 0.03	
"	7	50	Charging.....	19.3	18 65	18 7	1	30	0.6	
"	10	30	"	19.5	19.0	18.78	4	10	0.72	} + 1.33 " charge.
"	12	40	"	19.61	19.1	18.77	6	20	0.84	
"	17	45	Charged.....	20.40	19.26	19.1	11	25	1 30	
"	21	30	Discharging.....	19.95	19.25	19.1	3	45	0.85	
July 13.....	0	22	"	19.7	19.1	19.1	6	37	0.6	} — 0.67 " discharge.
"	2	55	"	19 73	19.2	19.16	9	10	0.57	
"	3	52	Discharged.....	.....	... .	.....	10	7	....	
"	3	58	Just started charging..	19.78	19.08	19.15	0	8	0.63	
"	10	20	Charging	20.0	19.2	19.15	6	28	0.85	
"	12	0	"	20 05	19.2	19.15	8	8	0.90	} + 0.77 " charge.
"	14	20	"	20.30	19.25	19.2	10	28	1.1	
"	15	30	Charged....	20.6	19.4	19.2	11	38	1.4	

On plotting the differences between the temperatures of the working and the idle cell and the corresponding times given in the last table, we obtain the dotted line 24 (Fig. 8) for the time fall of temperature during the first and third discharge, Curve 25 for the time rise of temperature during the first and third charge, Curve 26 for the time fall of temperature during the second and fourth discharge, and Curve 27 for the time rise of temperature during the second and fourth charges. 24 is dotted, since temperature readings were only taken at the beginning and end of the first and third of these discharges. In the case of the second and fourth of the discharges here referred to, as well as in all the four charges, several observations of temperature were made. From the curves it appears that toward the end of the discharge and at the beginning of the charge one or other of two things may happen—either the temperature in the discharge may go on falling, as in the dotted line 24, or it may begin to rise again, as in 26; whereas, in the charge, either the temperature at the beginning may rise considerably, as in Curve 25, or it may only increase slightly, as in Curve 27.

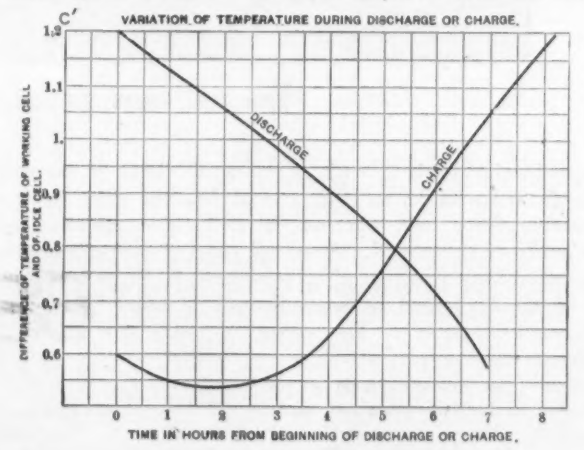

C'
VARIATION OF TEMPERATURE DURING DISCHARGE OR CHARGE.
DISCHARGE
CHARGE
DIFFERENCE OF TEMPERATURE OF WORKING CELL AND IDLE CELL.
TIME IN HOURS FROM BEGINNING OF DISCHARGE OR CHARGE.

FIG. 9.—TEMPERATURE CURVES.

It would therefore appear that during the latter part of the discharge one or other of two chemical actions can take place; and these two actions have, for some reason or other, taken place alternately in the four discharges under consideration. But, curiously enough, these four discharges—which took place on July 10, 11 and 12, 1889—occurred with extreme regularity; so that when time curves were drawn, even on a large scale, for each of these discharges, they coincided exactly and produced a single curve, which is shown, greatly reduced, as Curve 10 on the same sheet of curves given in the earlier part of the paper. And, similarly, for the four corresponding charges the four time curves all coincided exactly, producing a single curve, which is shown, greatly reduced, as Curve 11 on the same sheet. It, therefore, seems as if one or other of two chemical actions might take place during the latter portion of the discharge and during the earlier part of the charge; and yet, curiously enough, when the current is kept absolutely constant the time variation of the P. D. is exactly the same, no matter which of these two chemical actions takes place.

About a year later another set of *continuous* temperature observations was made for many days and nights with the same cells, the current in discharging and charging being, as before, 10 and 9 ampères, respectively. The higher P. D. limit was, as before, 2.4 volts per cell, but the discharge was in each case in this second set of continuous discharges and charges stopped at 1.9 instead of 1.8 volts per cell. As the regulation of the current day and night was in these later experiments in 1890 effected by hand, it was not kept quite as constant as when the automatic regulator was employed. Hence the time curves for the excess temperature in discharging and charging, when plotted, were not found to be as regular as in the previous case. But they were quite regular enough to give the general shape of the sets of temperature curves for discharge and charge which are shown in Fig. 9.

It will be observed that in these experiments not merely does the excess of the temperature of the working cell over that of the idle cell fall during the discharge, but it actually continues to fall at the commencement of the charge.

The times of discharging and charging are less than those given for Curves 10 and 11, partly because the P. D. was not allowed to run down lower than 1.9 volts per cell in the later observations, and partly because the times of discharging and charging had been diminished by the continued experimental rests to which these cells had been subjected in a charged state during 1889.

The mean temperature of one of our cells is during charging and discharging, roughly, 0.7 degree C. higher than that of the air; and experiment shows that if one of the cells experimented on be warmed up by a portion of the ordinary dilute sulphuric acid being replaced by warm sulphuric acid of the normal density, the cell will, after all parts of it have acquired a uniform temperature, fall in temperature by 0.2443 degree C. per hour. Of course, during such an experiment no current is allowed to pass through the cell, nor should any current have passed for hours before the heat emissivity of a cell is determined, otherwise a wrong value of the emissivity may be obtained by local action in the cell generating or absorbing heat during the experiment.

Hence, if K be the heat capacity of the cell, $0.7 \times 0.2443 \times K \times 21\frac{1}{2}$ calories (gram, centigrade) will be lost by radiation and convection during the $21\frac{1}{2}$ hours of charging and discharging. Now the weights and specific heats of the component parts of one of the cells under test are—

	Weight in gram.		Specific heat.
Dilute acid, sp. gr. 1.9.....	10,490	....	0.792
Lead and lead oxide.....	12.987	....	0.0315
Glass.....	3,402	....	0.198

Hence, 0.2443 K equals 2,295 calories, and the loss of heat in charging and discharging equals 34,520 calories. The total watt-hours given to a cell in charging was 228.2 (see Curve 11, page 124, for the *working* results obtained with the cells after the first rest of 10 days), therefore the energy in calories given to the cell was $0.24 \times 228.2 \times 3{,}600$, or 197,200 calories. Hence, in consequence of the cell being slightly warmer than the air during charging and discharging, there is a loss of energy from radiation and convection equal to about 17 per cent. of the energy put into the cell, and this is more than sufficient to explain the total loss observed in the energy efficiency experiments, which amounts to only about 13 per cent.

* Continued from THE ELECTRICAL WORLD, Aug. 23, 1890.

† "Contributions to the Chemistry of Storage Cells," *Proc. Roy. Soc.*, vol. xlvi., 1889, p. 304.

Indeed, it would almost seem as if a portion of this heat radiated must be supplied by an actual slow consumption of the material of the cell; so that, in addition to the reversible oxidation and deoxidation of the material, which is the characteristic of the secondary cell, there was a certain amount of non-reversible oxidation, which is the characteristic of the primary cell.

The loss of energy in consequence of the current having to overcome the resistance of the cell is of far less importance than the loss of energy due to the actual continuous radiation and convection from the cell, which is slightly warmer than the air. For the mean resistance during discharging of one of the cells experimented on may be taken as 0.004 ohm (see Section IX., Resistance, Figs. 12 and 13), and the mean resistance in charging as 0.0045 ohm. Hence, during the normal 10 hours of discharge with 10 ampères there will be generated,

$0.24 \times 10^2 \times 0.004 \times 10 \times 3{,}600$, or 3,456 calories,

and during the normal 11½ hours of charge with 9 ampères,

$0.24 \times 9^2 \times 0.0045 \times 11\frac{1}{2} \times 3{,}600$, or 3,621 calories.

Only, therefore, 3,456 calories need be dissipated during the discharge of a cell, and 3,621 during the charge, in consequence of the heat produced by the current overcoming resistance; and to dissipate this amount of heat it would only be necessary that the mean temperature of the cell should exceed that of the air by about 0.14 degrees C., or only about one-fifth of the actual mean excess. Whereas, what actually takes place is that during discharge about 16,000 calories are dissipated by radiation and convection; and, further, the cell cools down, possibly in consequence of the splitting up of the sulphuric acid, and from 6,000 calories in some experiments to 12,000 in others are thus absorbed. During the charge these 6,000 or 12,000 calories reappear warming up the cell, and, in addition, about 18,460 calories are dissipated by radiation and convection.

In order, then, to improve accumulators, what has to be especially sought for, and, if possible, then prevented, is that chemical action which keeps the mean temperature of the cell about 0.7 degrees C. above that of the air. This chemical action is very possibly quite distinct from the reversible one which necessarily accompanies the storing up of the electric energy and its subsequent liberation.

IX.—RESISTANCE.

The resistance in ohms of an accumulator when charging and discharging is given respectively by

$$\frac{V-E}{A}, \text{ and } \frac{E-V}{A}$$

where V is the P. D. in volts at the terminals when a current of A ampères is passing, and E is the E. M. F. of the

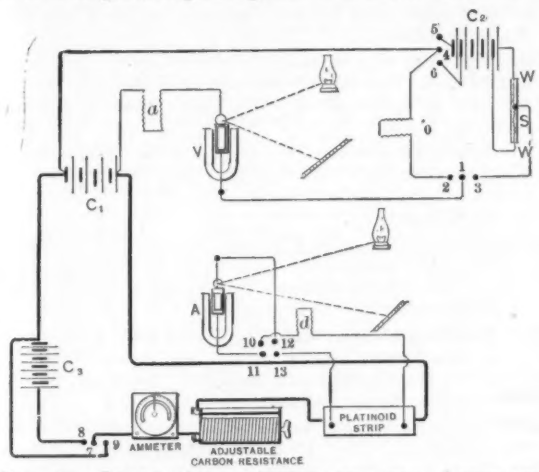


FIG. 10.—DIAGRAM OF APPARATUS FOR ACCURATE MEASUREMENTS.

accumulator at the moment V is measured. To measure E the main circuit is broken, and the P. D. observed as quickly as possible. On breaking the circuit, however, the deflection of the voltmeter does not sharply change from the value that measured V to another definite value that measures E; but, on the contrary, as seen from Fig. 4, in consequence of the fall of the E. M. F. of an accumulator on breaking the charging circuit, and in consequence of a similar rise in the E. M. F. on breaking the discharging circuit, the voltmeter deflection continues to vary for several minutes after the circuit is broken. Hence the value of E, measured by a voltmeter which is not infinitely dead-beat, must be too small during charging, and too large during discharging; and consequently, since the above formulæ for the resistance are only true when V and E are the *simultaneous* values of the P. D. at the terminals of the accumulator and of its E. M. F., it follows that the resistance has hitherto been measured too large both, in charging and discharging.

The magnitude of the error that has been thus made in different experiments depends, of course, on how dead-beat a voltmeter was employed, and, consequently, on how long a time was allowed to elapse between the breaking of the main circuit and the taking of the reading. For example, we find that toward the end of the charge with the normal current of 9 ampères the E. M. F. varies about 1 per cent. in 20 seconds after the circuit is opened. Now, as the difference between V and E, which measures the resistance, is only of the order 0.1 volt when it has its maximum value during the normal charge or discharge,—that is, of the order 4 per cent. of E—it follows that an error of 1 per cent. in the measurement of E would make an error of about 25 per cent. in the measurement of the resistance.

To measure the resistance accurately we ought to be able to measure the difference between V and E to one-thousandth of a volt, and, therefore, as E is about 2 volts, the voltmeter must be very sensitive, with a long, open scale, and the needle must move through a considerable angle; whereas, in consequence of the rapid variation in E, the voltmeter must be very dead-beat—a condition almost incompatible with a long range and great sensibility.

These two conditions, however, we have fulfilled by the employment of the following device, by means of which the difference between the values of V and of E was measured to the one-thousandth of a volt at identically the same moment that the values of V and A were measured. The process was as follows:

1st. The sensibility of the voltmeter was adjusted so that 12 volts produced a deflection of 600 divisions, and V, the P. D. at the terminals of the four accumulators under test, was measured.

2d. A compensating E. M. F. was introduced into the circuit, just sufficient to bring the spot of light to zero.

3d. The sensibility of the voltmeter was increased 60 times.

4th. The main circuit was broken, and the time variation of E, the E. M. F. of the accumulators under test, observed by noting the position of the spot of light at the successive ticks of a metronome, whose rate of going was before each experiment carefully adjusted by comparing the metronome with a chronometer.

5th. A time curve for the values of E was drawn, and by producing it back until it cut the line passing through time nought—that is, the time when the main circuit was broken—we obtained the value of E at the same moment that the values of V and A were measured.

The apparatus employed is symbolically shown in Fig. 10. C_1 are the four accumulators under test; when they were being charged by means of the accumulators C_2, a bridge-piece was placed so as to join the mercury cups 7 and 8; whereas, when C_1 were being discharged, mercury cup 7 was joined to 9 instead of to 8. In both cases the current passed along the thick lines through an A. and P. magnifying spring ammeter, whose indications furnished an approximate measure of the current, through an adjustable carbon resistance and a platinoid strip which could carry the maximum current, 10 ampères, used in these tests, without its resistance being perceptibly altered. To two points of this strip were soldered two wires going to the mercury cups 10 and 13; these were joined respectively to 11 and 12 in charging, and to 12 and 11 in discharging, so that the current always went through the D'Arsonval galvanometer A in the same direction. This galvanometer then measured the charging or discharging current, its sensibility being such that for a current of 9 ampères passing through the circuit a deflection of 600 scale divisions was produced when the resistance in d was 185 ohms, that of the galvanometer A itself being 52 ohms.

By joining the mercury cups 1 and 2 with a bridge-piece,

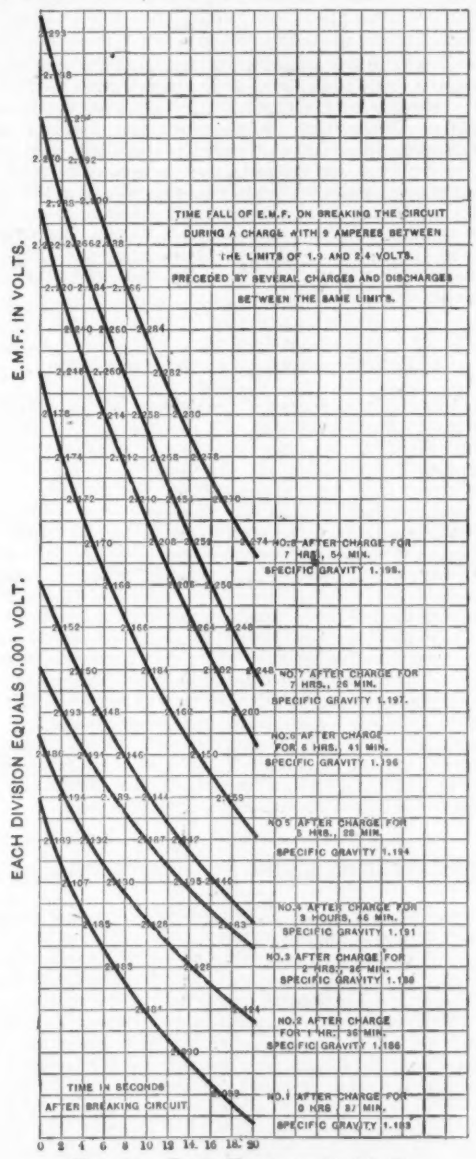

TIME FALL OF E.M.F. ON BREAKING THE CIRCUIT
DURING A CHARGE WITH 9 AMPERES BETWEEN
THE LIMITS OF 1.9 AND 2.4 VOLTS.
PRECEDED BY SEVERAL CHARGES AND DISCHARGES
BETWEEN THE SAME LIMITS.
E.M.F. IN VOLTS.
EACH DIVISION EQUALS 0.001 VOLT.
NO.8 AFTER CHARGE FOR 7 HRS., 54 MIN. SPECIFIC GRAVITY 1.198.
NO.7 AFTER CHARGE FOR 7 HRS., 26 MIN. SPECIFIC GRAVITY 1.197.
NO.6 AFTER CHARGE FOR 6 HRS., 41 MIN. SPECIFIC GRAVITY 1.196
NO.5 AFTER CHARGE FOR 5 HRS., 28 MIN. SPECIFIC GRAVITY 1.194
NO.4 AFTER CHARGE FOR 3 HOURS, 46 MIN. SPECIFIC GRAVITY 1.191
NO.3 AFTER CHARGE FOR 2 HRS., 46 MIN. SPECIFIC GRAVITY 1.186
NO.2 AFTER CHARGE FOR 1 HR., 36 MIN. SPECIFIC GRAVITY 1.186
NO.1 AFTER CHARGE FOR 0 HRS. 37 MIN. SPECIFIC GRAVITY 1.169
TIME IN SECONDS AFTER BREAKING CIRCUIT
0 2 4 6 8 10 12 14 16 18 20

FIG. 11.—TIME FALL OF E. M. F.

the P. D. between the terminals of the accumulators under test, C_1, could be measured with the voltmeter V; the sensibility being such that with a resistance of 791 ohms in a, and 63,696 ohms in b, a deflection of 600 scale divisions corresponded with a P. D. of 12 volts. By connecting the mercury cup 1 with 3 instead of with 2, the resistance b was cut out of the circuit, and the sensibility of the voltmeter V was increased 60 times. If now 4 were connected with 5 or with 6, and the sliding contact S moved along the thick wire WW, a point could be found such that no current passed through the voltmeter V. Next, the main circuit indicated by the thick wires was broken, when the spot of light would move quickly across a portion of the scale, and then continue moving right across the rest of the scale. The first part of this motion was of course due to the sudden variation of the P. D. at the terminals of the accumulators C_1 on the current through them being stopped, while the continuation of the motion was due to the subsequent variation of the E. M. F. of these accumulators after the current was stopped. And the value of the E. M. F. at any moment was equal to

$$V \pm \frac{0.2\ d}{600},$$

where d was the deflection of the voltmeter spot of light at the moment in question, and V was the P. D. between the terminals of the cells C_1 just before the main circuit was broken, and which was measured by the voltmeter deflection when mercury cup 1 was connected with 2. In discharging the + sign was, of course, used, and in charging the — sign.

This P. D. at the terminals of the four accumulators under test, C_1, and which had to be balanced by the E. M. F. of the accumulators C_2, approached 9.6 volts toward the end of a charge, while it fell 7.6 volts at the end of a discharge. In the former case the E. M. F. of four cells and a portion of the fifth of the compensating accumulators C_3 was employed, while in the latter the E. M. F. of three and a portion of the fourth sufficed. Hence, during the charge mercury cups 4 and 5 were connected together, while during the discharge it was 4 and 6 that were connected together. The portion of the E. M. F. of the last of the compensating cells was, as shown in the figure, obtained by shunting this cell through a platinoid wire, WW, of about two ohms resistance, and making contact with a point of this wire farther from, or nearer to the positive pole of this cell. This adjustment of the position of S caused very little change in the resistance of the voltmeter circuit, because the resistance of WW was but a small portion of the entire resistance in the voltmeter circuit.

This method of measuring the resistance of accumulators was applied by three of the students of the Central Institution—Messrs. Müller, Stephens and Wightman—to determine the variation of the resistance during the entire discharge of the cells with 10 ampères, and charge with 9; further, during May and June of this year Mr. Müller has, with great perseverance, been making an uninterrupted series of observations, day and night, to determine the resistance during the entire discharge and charge for various currents. For each of these currents the cells are being brought to a steady working state by many discharges and charges being successively and without interruption made with each current. In the case of the small current the time of a charge and discharge is tediously long, the charge, for example, with three ampères requiring 40 hours to raise the P. D. from 1.9 to 2.4 volts per cell, so that several weeks have to be spent obtaining the resistance for this current. This investigation of resistance is not yet completed, and, therefore, we do not propose in this paper to refer to the variation of the resistance of a cell with different currents when the cell is brought to a steady working state for each current. Such an experiment has not, as far as we are aware, ever before been attempted with accumulators, former observers having contented themselves with merely observing the variation of the resistance when the current during discharge or charge was abruptly changed from one value to another. This is a very different thing from ascertaining how the resistance of an accumulator varies with the current when each of the different currents employed is steadily used for some weeks in the discharging and charging of the cell, until the cell has arrived at a steady working state for the current in question.

We give in Fig. 11 an example of the time fall of the

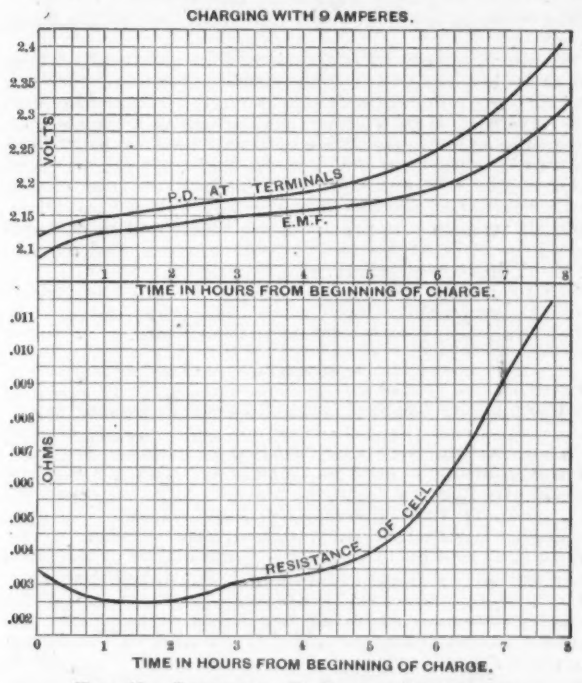


FIG. 12.—CURVES OF P. D. AND RESISTANCE.

E. M. F. on breaking the circuit for eight periods of 20 seconds during the charge. The curves are all drawn to the same scale, but, in order to get the curves into a reasonable space, a different zero line has been employed in drawing each curve. The actual E. M. F. in volts per cell is given for several points on each curve, so that the time rise at any period of the charge can be easily seen. The E. M. F. at the moment of breaking the circuit in each case is, as already explained, obtained by seeing at what point the curve cuts the vertical line through the time 0. The value of this point in volts is, in fact, what an infinitely dead-beat voltmeter would indicate immediately after the circuit was broken. It will be observed that the time fall of E. M. F. on breaking the circuit becomes more and more rapid as the charge continues.

The top curve in Fig. 12 gives the P. D. at the terminals of one accumulator, charging with nine ampères; while the second curve gives the simultaneous values of the E. M. F., being, in fact, the curve drawn through points whose abscissæ are the times—0 hours 37 minutes, 1 hour 36 minutes, etc.—for which the eight curves on Fig. 11 are drawn, and whose ordinates are the values of the points where these curves cut the vertical line drawn through the zero of time in Fig. 11, or time when the charging circuit was broken. The lowest curve on Fig. 12 gives the resistance of the cell at any moment during the entire charge with nine ampères, the ordinates of this curve being calculated from the formula

$$\frac{V-E}{9},$$

where V and E are values of the P. D. and the E. M. F. of the cell at the same instant.

As the charging proceeds the resistance of the accumulator at first falls, and reaches a minimum; it then increases, at first slowly, but as the charging approaches the finish the resistance rises very rapidly, so that when the P. D. per cell is 2.4 volts the resistance is five times as great as its minimum value, which is reached shortly after the commencement of the charging. Taking 0.045 ohm as the average resistance during charging, and remembering that there are in these cells two positive plates each surface of which is 9½ into 9½ inches, and that all four surfaces are equally active, it follows that the mean resistance of the 1888 E. P. S. type of cell while charging with the maximum current-density allowed—viz., 3.787 ampères per square foot—is about 0.11 ohm per square foot of positive plate.

Fig. 13 gives the P. D. at the terminals of one of the cells during the whole of a discharge with 10 ampères, the

simultaneous values of the E. M. F. and of the resistance. The resistance at the commencement of the discharge is a little higher than at the commencement of the charge, and the minimum value to which it diminishes is not as low as the minimum attained by the resistance in charging. At the end of the fifth hour of discharge and charge the resistance is practically the same. After that, however, there is a marked difference, the resistance in discharging does not rise as rapidly as in charging, and hence, since, in addition, the time of a discharge is necessarily less than of a charge, the resistance never reaches as high a value in discharging as in charging.

If we take 0.038 ohm as the mean resistance during a discharge with 10 ampères, then it follows that the mean resistance of the 1388 E. P. S. type of cell while discharging with the maximum current-density allowed, viz., 4.208 ampères per square foot, is about 0.09 ohm per square foot of positive plate.

Both in charging and in discharging with constant currents, the greater part of the time variation of the P. D. at the terminals of an accumulator is due to an actual variation in the E. M. F. itself; and it is only toward the end of the charge and of the discharge, when the resistance of the cell becomes relatively large, that the slope of the P. D. curve becomes practically different from that of the E. M. F. curve.

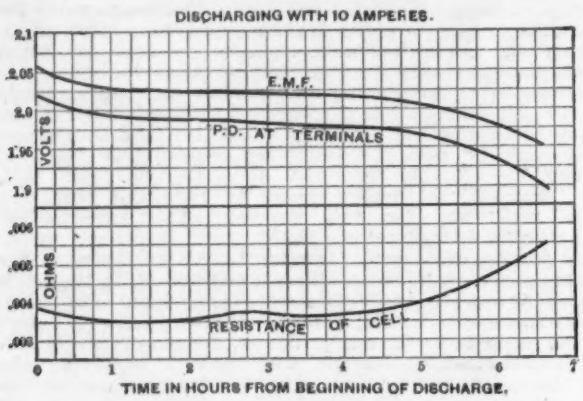


Fig. 13.—P. D. at Terminals of One Cell During Discharge.

We may mention in conclusion, that the results which we have obtained with accumulators made to go for long periods through definite cycles in charging and discharging, have been so interesting that we are now engaged on the design of an apparatus which will automatically keep the current constant for any time at any pre-arranged value, which will automatically change over from charge to discharge, or from discharge to charge, when the P. D. per cell reaches any pre-arranged limit, and which will record the P. D. at the terminals of the cell, and also its E. M. F. during the whole period.

We hope, therefore, at some future period to be able to present a graphical record of the life history of accumulators from their first formation to their death.

Continuous Current Transformers in Operation.

We noted some weeks ago the first adoption, in England of the continuous current transformer, and we are now able to give in some detail the methods of its use on an extive scale by the Chelsea Electricity Supply Company, Limited. The system is, of course, that devised by Mr Frank King and his colleagues. According to *Industries*, there are three distinct uses to which the transformer may be put, as adopted by the Chelsea Company: 1. Supplementing the batteries during the hours of maximum demand in the winter months, and thus rendering the charging plant available to swell the possible rate of supply to the highest possible figure. 2. Minimizing the discharge from the batteries when it is desired to keep as large a store as possible to meet a special occasion, or against a foggy day. 3. Feeding the network during the disconnection of both halves of a sub-station battery, should it be desired so to disconnect it on any occasion.

Briefly stated, the system adopted by the Chelsea Company is as follows: A number of sub-stations are distributed over the area of supply, each furnished with a large storage battery, which is divided into two equal parts, so that one part may be charged while the other part is connected to the distributing network. At the charging station sets of independent engines and dynamos, coupled direct, are provided. The field magnets of all the dynamos are separately excited from a compound dynamo giving constant e.m.f., the armatures are connected in series, and the two extreme terminals to the charging mains. Each engine and dynamo is proportioned so as to be economically loaded when delivering sufficient energy to charge one of the half-batteries at a sub-station, and the number of sets of engines and dynamos is one more than the number of sub-stations (of which there are four), so as to leave a set in reserve.

The half-batteries at the sub-stations are connected all in series by the charging mains. The half-batteries are in sets of 55 in series, the sets being connected in parallel during discharge, and in series for charging. The charging current is maintained practically constant, and the number of charging plants in operation always equals the number of half-batteries being charged. The alternation of the battery connections from parallel for discharging to series for charging, as well as the changing over from one half-battery to the other when the first has been sufficiently charged, is effected entirely by Mr. King's automatic devices. The e.m f. required for charging at each sub-station is about $220 \times 2.5 = 550$ volts. The foregoing description of the system will enable the conditions under which the continuous current transformer works to be readily understood.

The transformer consists of a drum armature dynamo, having two independent armature windings and a commutator at each end. The ratio of the windings to each other is approximately 5 4 to 1. The field magnets are of the upturned vertical type, and are excited from the low-tension terminals. The transformer has a normal output of 33,500 watts, and runs at 1,000 revolutions per minute. As the total charging e. m. f. reaches 2,200 volts, it is necessary to maintain perfect insulation between the charging and discharging circuits. With the batteries this is of course easy, as the two halves can be mounted on sets of shelves well separated from each other; and in the automatic devices a clear stretch of enamelled slate is interposed between the contacts connected with the charging and supply mains respectively. On the armature of the transformer, however, the high-tension charging circuit is brought into close proximity with the supply circuit, so that special precautions are necessary to secure sufficient insulation resistance between the windings. The means adopted consist in winding the high-tension coils into thin ebonite troughs. This has proved sufficient thus far, but ebonite seems to be an unsatisfactory material to use in the construction of an armature.

At the time this account was written the insulation resistances were given as follows:—

Between the winding	17	megohms.
" the thick wire and frame	7.5	"
" the thin wire and frame	9	"

The transformer had been running at full load for about two hours every night since May 19 last, and during that time the insulation resistances had been steadily rising. As a safeguard the Chelsea Company have a Cardew safety device fixed at Draycott Place. The transformer has been manufactured by the Electric Construction Corporation, Limited, and supplied on approval to the Chelsea Company, who are so satisfied with its performance that they have decided to purchase it.

The following table gives the readings taken at a recent experimental trial of the transformer, also the commercial efficiency attained:—

	Primary.		
No. of Reading.	E.M.F. at Terminals.	Current.	Watts. Absorbed.
1	604	72.5	43,790
2	606	72.5	43,935
3	588	64	37,632

Continued from above.

Secondary.			
E. M. F. at terminals.	Current.	Watts. delivered.	Commercial efficiency.
111.5	320	35,536	81.3 per cent.
111.5	327	36,313	82.5 per cent.
110.5	280	30,814	82.2 per cent.

The e.m.f. at the secondary terminals of the transformer is adjusted a trifle high, so that it always runs at full load. Thus the engine and dynamo are always economically loaded also. In starting the transformer, the low-tension terminals are connected to the battery circuit (the magnet circuit being first completed), and when sufficient speed has been attained the high-tension current is switched on. This sends the speed up, and when the e.m.f. generated in the low-tension winding exceeds that of the batteries, the current in it reverses, and the low-tension part of the armature becomes a generator driven by the motor action of the high-tension winding.

A Notable Exhibit at the Convention.

An exhibit that attracted a great deal of attention was that of the Sawyer-Man Electric Company, in charge of Mr. S. J. O'Reilly. An excellent line of incandescent lamps was displayed comprising the standard 16 c. p. lamps in various colors and with opal and ground bulbs. Several large incandescents of 150 c. p. stood out prominently among their smaller companions, and beside these were the incandescent lamps for arc circuit in sizes of 25. 50, 75 and 100 c. p. A special lean tubular 16 c. p. lamp for inpecting the interior of casks was noticeable among the others. But the particular feature of the exhibit was the new compound, "Alexite." It is a dense, hard material, and possesses high insulating properties, is waterproof, acid proof and very slightly affected by fire. The specimens shown were modern imitations of various sorts of wood and marble, and were very attractive in appearance. Cut outs and a large variety of small goods are to be made of the "Alexite," and will be ready for the market in the early Fall. The well-known Bryant switches are soon to be furnished with "Alexite" bases.

Diamagnetism Tested by Carnot's Principle.

In a recent number of the *Philosophical Magazine* appeared a short paper by Mr. J. Parker, of Cambridge, says the London *Electrician*, in which Carnot's principle was applied to diamagnetism. An oversight occurs in the paper, which has since been corrected by M. Duhem, who has adopted and extended the substance of the paper. The present state of experiment and theory on diamagnetism may be briefly stated thus: (1) If a piece of bismuth be placed near a strong iron magnet in the open air, the bismuth behaves as if repelled by the iron. (2) If the same experiment were performed in a vacuum, it is shown by Carnot's principle that the bismuth would not be repelled, and might be attracted. It is therefore concluded that if the experiment were performed in a place from which the air could be pumped away at will, the repulsive force on the bismuth would become zero when the pressure of the air was sufficiently reduced, and by continuing the exhaustion still further it would probably become attractive. The action of the bismuth in the open air will be explained if one remembers that both the iron and the bismuth are surrounded by a mass of magnetized air, so that the behavior of the bismuth is due to three causes: (1) The attraction of the iron magnet. (2) The attractions of the magnetized atoms of air. (3) The resultant of the unequal pressure of the air over the surface of the bismuth. The conclusions of this paper naturally lead us to question the propriety of making our "absolute" units of electricity and magnetism depend on the actions between bodies surrounded by electrified or magnetized air, about which all that is known is that, at some distance away, the air with which it is in equilibrium has a measurable pressure.

Manufacture of Vermillion by Electrolysis.

This interesting process is described in a recent number of the London *Electrician*. In a wooden vat, one metre in diameter and two metres deep, circular plates 15 centimetres wide are placed against the sides, and on these the mercury is exposed, one centimetre deep. These plates are connected with the positive pole of a dynamo. At the bottom of the vat is a sheet of copper electroplated with iron, and connected with the negative pole. The vat is filled with a solution of 8 ger cent. of nitrate of ammonia and 8 per cent. of nitrate of soda. A worm, pierced with holes, supplies a constant regulated current of sulphuric acid; the excess of gas escapes by a tube projecting from the lid. A screw agitator keeps up a thorough mixture in all parts of the liquid. When the current passes it immediately forms a precipitate of red sulphide of mercury. Attempts have been made to dispense with the current of sulphuric acid by making up the bath with: Water, 100 litres, nitrate of ammonia, 8 kilos; nitrate of soda, 8 kilos; sulphur, 8 kilos; Under these conditions one need only add sulphur and mercury to extract at the end of the operation vermillion which rivals that which can be obtained by sulphate of ammonia.

Special Correspondence.

NEW YORK NOTES.

Office of The Electrical World,
167-177 Times Building, New York, Aug. 25, 1890.

The Self-Winding Clock Company is out with a neat little card circular, announcing its readiness to furnish time from the Washington Observatory, over Western Union, at $1 a month.

The North American Phonograph Company has declared a semi-annual divivend of three per cent., payable Aug. 28, to stockholders of record Aug. 15. The actual output of new machines during the month of July was 446, and the company had unfilled orders, Aug. 1, for 235 machines additional, with fresh orders coming in daily.

Mr. E. G. Bernard, agent of the Westinghouse Company, reports the following recent sales: Victor Knitting Mills, Cohoes, N. Y., 300 lights; Brandywine Knitting Mills, Schenectady, N. Y., 150 lights; Wm. H. McClymann, residence, Schenectady, N. Y., 60 lights; Austin Stairs and Blauvelt Knitting Mill, Amsterdam, N. Y., 150 lights; Chesapeake Knitting Mills, Norfolk, Va., 100 lights; Packard Electric Company, Warren, Ohio, 50 lights; J. M. Quackenbush, Rifle Factory, Herkimer, N. Y., 150 lights; J. M. Quackenbush, residence, Herkimer, N. Y., 50 lights; E. H. Plummer, Rose Hill Farm, Geneva, N. Y., 75 lights.

The Board of Electrical Control held a meeting at the Mayor's office this week, but took no action upon the request of the Fire Department for a separate duct for its wires, instead of using a compartment in the subways in common with the Police Department. The Mayor referred the correspondence on the subject to Electrical Expert Wheeler. Applications for subways in various streets were laid over. Chief Engineer Kearney was instructed to go on with the testimony regarding the amount of rentals which the subway company should receive for the use of its ducts from the electric light companies. The yearly sum of $1,000 per mile is thought to be the amount likely to be fixed. A subway was authorized to be built through Eighty-fourth and Eighty-sixth streets, from Third avenue to the East River, for electrical conductors for lighting the East River Park. W. T. H.

NEW ENGLAND NOTES.

Branch Office of The Electrical World,
Room 8, Cook Building, cor. Franklin and Congress Sts.
Boston, Aug. 23, 1890.

On a Vacation.—Superintendent Rice and Professor Thomson, of the Thomson-Houston Electric Company, are on a trip among the White Mountains.

The first trial trip of the Gloucester Electric Railway took place last Monday evening. Two trips were made from the power station to the Riverdale Mills. The double trolley system of the Daft company is issued.

A New Boiler Ordered.—The boiler in the works of the Electric Light Company at Windsor Locks, Conn., having given out, a water wheel has been put in to furnish the power. A new boiler of 25 h. p. has been ordered.

Lynn, Mass.—The Lynn & Boston Railroad has been granted the right to put up poles and wires in Lynn as follows: In Essex street from Ireson to the Swampscott line, and in Mason, Chatham and Maple streets and Western avenue.

The Reading (Mass.) Electric Light and Power Company has been formed with a capital of $12,000. Wendall Bancroft, president; L. M. Bancroft, treasurer; the same and J. W. Richardson, J. A. Horton and E. A. Hunt, directors.

Explosion.—A manhole belonging to the Edison Electric Illuminating Company, located at the corner of Court and Hanover streets, blew up early Thursday morning. As far as could be learned, no one was injured. The explosion is attributed to sewer gas.

Salem, Mass.—The Naumkeag Street Railway Company, having completed the equipment of its "Willows" line with the Sprague system, ran a trial trip over the line last Saturday night. It is expected to have the electric cars running from Peabody to the Willows this week.

Methuen, Mass.—The Selectmen gave an extended hearing last Wednesday night to the Methuen Gas Ligh. Company, which has petitioned for the privilege of lighting the town by electricity. The Lawrence Gas Company put in a remonstrance. The Selectmen reserved their decision.

Pittsfield, Mass.—The new electric light and power company at Pittsfield, Mass., has purchased a lot, on the side of which will be erected the new station to contain dynamos for light and power and a steam heating establishment. The main building will be 60 by 90 feet, and will be two stories, of brick. The boiler house will be one story, 60 by 40 feet, of brick.

Newport, R. I.—A special meeting of the City Council was held last Monday night to act on the recommendation of the chief engineer of the Fire Department that the City Council authorizes him to relocate the poles that are now on the sidewalks in front of the property of Mrs. Ashurst, on Bellevue avenue, and which she has threatened to cut down. The poles carry electric light wires and wires for the electric street cars, and if they are cut down both of these services will be crippled.

The adjourned public meeting of the petitioners of the Woburn Electric Light Company, the Citizen's Gas Light Company, of Wakefield; the Reading Rubber Mills Company, and the Reading Electric Light and Power Company for the right to erect poles and string wires within the town was held at the rooms of the selectmen last Monday evening. H. C. Buck represented the Woburn Company, S. K. Hamilton the Gas Company, and Wendall Bancroft the Reading Company, The rubber mill was not represented.

The National Electric Construction Company, recently incorporated, has opened its offices at 620 Atlantic avenue, Boston, Mass. The capital stock of the company is $2,000,000. The following named gentlemen are the officers of the company: Gen. Benj. F. Butler, president; A. H. Sawtell, vice-president and general manager; Hon. Lynus N. Child, treasurer; T. Henry Pearse and Allan V. Garratt, managers of the electrical and engineering departments. Mr. F. Z. Maguire, of 18 Wall street, New York, is the financial agent, and is handling the securities of the company.

A communication from Mayor Hart to the Boston Board of Aldermen indicated his disapproval of the order of the Board of Aldermen to the effect that the superintendent of streets appoint inspectors for superintending the work of the New England Telephone and Telegraph Company, the inspector to be paid by the company, on the ground that the Public Statutes, chap. 28, sec. 4, provide that the regulations of the city for the erection and maintenance of all telegraph and telephone lines shall be made by ordinance, and an order passed by the aldermen is not an ordinance of the city. L. H. H.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
31 CITY BUILDING, PHILADELPHIA, AUG. 23, 1890.

Messrs. Morris, Tasker & Co., of Philadelphia, are doing an extensive business in wrought iron electric light and street railway poles.

The Camden Thread Company, of Philadelphia, is increasing its facilities for the manufacture of glazed cotton for insulating by the addition of three new dressers and new doublers.

Messrs. Wm. H. Watson & Co., of Philadelphia, are turning out some very nicely finished knife edge switches. They now have in process five double pole 300 ampère switches for Messrs. Walker & Kepler.

The Thomson-Houston Company has just made the following installations from its Philadelphia office: Three 400-light machines at the Hollingsworth Ship Yards, Wilmington, Del.; one 35 arc light machine for the Williamsport & Chesapeake Lumber Company, Sparrows Point, Md.; one 35 arc light machine for the Midvale Steel Company, Tioga.

Will Stand Water.—In October, 1888, the Thomson-Houston Company, through its agent, Mr. L. E. Snow, installed a 35 arc light dynamo for the Lockhaven Gas Company, Lockhaven, Pa. During the Johnstown flood in May, 1889, the dynamo was completely submerged for over 24 hours. Mr. F. H. Thomson, the company's expert was sent for, and had the dynamo working perfectly within a week after the flood, without moving it from its foundation, and it has been running a full load ever since. W. F. H.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
465 The Rookery, Chicago, Aug. 23, 1890.

M. A. Groetzinger, president of the German National Bank of Pittsburgh, has been elected vice-president of the Charles Munson Belting Co., of Chicago.

Mr. William Hood, the Chicago representative of the Accumulator Company, is supplying twelve "23 M." cells to operate a motor that will be used in polishing signs and cleaning windows.

Telegraphs Interrupted.—An accident to the machinery used to furnish dynamo current to the Western Union wires in Chicago stopped all communication with the outside world for a few minutes on the morning of Aug. 21. Matters were soon set right.

Organization of Joint Stock Companies.—E. B. Meyers & Co., 147 Monroe street, Chicago, have issued the fourth edition of their excellent work on this subject, and have published a new work on city and village laws that is of interest to the seller of electric lighting and railway apparatus.

The Business Men's Association of Evanston, Ill., is having several "floats" fitted up to represent its respective industries in the annual parade and picnic, and will have the same lighted at night with incandescent lights, the necessary current being furnished from Pumpelly storage batteries carried on each wagon.

Mr. W. P. Browne, Chicago, is about to place three or four tricycles driven by "C. & C." motors that are operated by storage cells of the Pumpelly type, on the street for advertising purposes. The indications are that the device will prove profitable from the start, and applications are coming in from other cities for the use of machines.

Telephone Quotations.—Col. S. G. Lynch, broker, 153 Monroe street, Chicago, furnishes quotations on telephone stocks as follows:

Chicago	$298@$300	Cumberland	$ 59@ $60
Central Union	66@ 67	Wisconsin	116@ 117
Michigan	98@ 99	Bell of Missouri	140@ 145
Great Southern	30@ 32	Iowa Union	21@ 23
Colorado	38@ 40	Missouri and Kansas	54@ 55
Rocky Mountain Bell	40@ 45		

ELECTRIC LIGHT STOCKS.

Chicago Arc Light and Power	$104@$105	Chicago Edison Co	$125@$130

Mr. L. L. Summers, assistant electrician Western Union Telegraph Company, Chicago, is in possession of one of the finest electrical reference libraries in the country, having secured a complete and perfect file of THE ELECTRICAL WORLD from first to last number, and complete files of other scientific journals, foreign as well as American. Mr. Summers also has duplicate sets of some of these journals, and will exchange same with persons desirous of completing their files. Mr. Summers has also added to his library a copy of nearly every important work on the science of electricity. So complete a collection is rarely found, and will continue to increase as time goes on. Possibly it would be a valuable addition to the electrical section of the World's Columbian Exposition.

F. DEL.

ENGLISH NOTES.

(From our own correspondent.)

LONDON, Aug. 13, 1890.

Hughes Telegraph Instrument.—The recent changes in the working of the cables between England and the Continent have introduced a considerable number of Hughes printing instruments into the General Post Office. These instruments, though largely in use in France, Germany and Italy, are too slow for most of our lines. The post office is working daily from London to Rome, with several relays on the line.

British Association.—The annual meeting of the British Association will take place at Leeds, at the beginning of next month. The locality is full of interest to engineers and scientific men, offering as it does facilities for visiting a greater variety of manufacturing establishments than any other part of England. The usual range of attractions will be offered, varying from abstruse impromptu utterances of Sir William Thomson down to geological picnics.

Injuries by Lightning.—Several deaths and numerous cases of injuries resulted from a severe but brief thunderstorm last week. In the majority of cases it is reported that the unfortunate persons were injured at their feet, no marks being visible on other parts of their bodies. This has been observed before, but it appears to have been more than usually pronounced on these occasions. It is possible that the different kinds of discharges described by Dr. Oliver Lodge may produce different effects, and it is possible that one kind predominated last week.

The City and South of London Railway.—This electrical railway is now approaching completion. The engines and trains are running for the purpose of accustoming the staff to their duties. The delay has been due chiefly to the lifts, which were not supplied by the promised time. This has indirectly delayed much of the other work. Experiments have been made on lighting the stations by electricity from the power mains, but it was found that the switching on and off of the engines caused too great fluctuations; no doubt a separate service or some modification will be made to allow this to be done.

News of the Week.

THE TELEPHONE.

Tokio and Yokohama, Japan.—The government has taken telephone matters into its own hands, and is starting an exchange in Tokio, which will shortly be followed by one in Yokohama. When both are in thorough running order they are to be united by trunk lines, the distance between the two cities being only 18 miles. The rental is to be $50 per annum, with a small additional charge for use of the inter-city line.

THE ELECTRIC LIGHT.

Additional Towers.—The Allegheny City authorities propose to erect 10 additional electric light towers and 100 mast arms.

On a Vacation.—Daniel McGinley, foreman of the Edison Company's inside wiremen at Elizabeth, Pa., is off on a trip of two weeks to Michigan with the T. J. Wallace Rod and Gun Club, of Pittsburgh.

Philadelphia, Pa.—The Philadelphia market house is to be illuminated by the Westinghouse alternate current arc lighting system in the near future. The Westinghouse company has sold the city officials a 40-light plant for use in the market house.

Wilmerding, Pa.—The Turtle Creek Valley Electric Company is about to add a 60-light arc machine of the new Westinghouse alternate current type to its central station equipment. It already has in service 1500 lights capacity of Westinghouse incandescent dynamos.

The San Antonio Gas Company, of San Antonio, Texas, appears to be well satisfied with the working of the Westinghouse alternate current incandescent system. It has at present in operation Westinghouse apparatus to a capacity of 1,500 lights, and is just placing an order for a 750-light increase.

Anaconda, Mont.—One of the progressive towns of the rich mineral state of Montana is Anaconda. An electric light company has been formed in Anaconda and the Westinghouse incandescent system has been chosen. The plant will have an initial capacity of 3,000 incandescent lamps of 16 candle power each, and 60 arc lights.

Increasing Business.—The East End Electric Light Company, of Pittsburgh, Pa., is enjoying a constantly increasing patronage. The demand of the public for illumination is so pressing in every direction in the district to which the East End company caters that it is necessary for the company to extend its lines and add to its capacity constantly.

New Whatcom, Wash.—The new state of Washington is a pretty lively place. There is no lack of enterprise within it. The towns of the state are rapidly adopting electricity for lighting and motive power purposes. The electric lighting company of New Whatcom has decided upon the Westinghouse alternate current system and will immediately install a 750 light plant.

Susquehanna, Pa.—The new plant of the Susquehanna Light, Heat and Power Company has just been put in operation. It consists of two 40-light arc and one 1,200-light incandescent Westinghouse dynamos, with Westinghouse Junior engines. The Schieren perforated belting is used. The plant was put in by the Otis Electrical Supply Company, of Binghampton, N. Y., which intends opening an office in New York City in the near future.

Electric Lights in Brazil.—Our Spanish-American neighbors are beginning to see the advantages which electricity possesses as an illuminant. Some time ago the Westinghouse Company sold a 1,500-light alternate current incandescent outfit to be used towards dispelling darkness in the Brazilian town of Juiz de Fora. The Juiz de Fora company is well pleased with its purchase, and has just asked the Westinghouse people to ship a 750-light machine to supplement the present capacity of its central station.

Japanese Lighting.—There are, according to the latest figures, over 11,000 electric lights in Japan operated from central stations, besides a large number of installations; and this number will be doubled within the year. The Tokyo Electric Light Company has four stations, equipped for 6,200, 2,200, 2,200 and 2,200 lights respectively, and other notable plants are at Kyoto (2,200), Kobe (2,200), Asaka (3,500), and Nagoza (1,600). Most of these stations are now running about half their capacity, and are putting in new lights rapidly.

Ware, Mass.—The Ware Power Company has purchased the salvage stock and interest of the Thomson-Houston Electric Light Company, of Lynn, in the electric light plant at Ware. The electric light station at Ware was burned to the ground one month ago, and was about to be rebuilt when purchased. Col. E. H. Gilbert is president of the new company, and guarantees to have the streets and stores of Ware lighted by electricity in a week. A temporary building is to be erected at once, and a permanent building will be erected in October with double the capacity of the old one.

Uniontown, Pa.—The Town Council at its last meeting granted Mr. S. E. Ewing the privilege to construct a new electric light line, with poles, wires, etc., in the various parts of the town. Some slight changes were made in the wording of the ordinance as presented by Mr. Ewing. It was discretionary with the council instead of the borough engineer where the poles should be located. A motion was made by a member to extend the present electric street lighting contract from three to five years, alleging that the consolidation of the present and proposed companies might result in high prices. Others opposed this motion, holding that electric street lighting would be so much cheaper three years hence that the present good bargain would be considered enormous. The motion was laid over for further consideration.

The Pumpelly Storage Battery Company, Chicago, has installed a plant of 264 Pumpelly cells, with 14 counter E. M. F. cells at the new Edison substation in Detroit, where the current will be used in house lighting. The plant in addition to the above number of cells, consists of two seven-point cut-out switches, five Andrews switches, three automatic switches, one gang switch, four ampère meters and three rheostats. The cells are connected in three sets of 88 cells each, placed in series with independent discharge feeders; or they may be thrown into four sets of 66 cells each, placed in parallel, on each side of the main discharge circuit. During the short time the battery has been in use it has given good satisfaction and enables the company to furnish current durthe entire 24 hours, though only operating the dynamos and engines about ten hours per day. The cutting into circuit of either dynamos or batteries is instantly effected without a perceptible change in the lights. This is one of a number of plants the Pumpelly company has installed as aids to central station lighting.

APPLICATIONS OF POWER.

The Du Quoin Street Railway Company, at Du Quoin, Ill., has been incorporated to carry passengers and freight. Capital stock, $10,000. Incorporators, Henry Horn, P. N. Pope and P. D. Mifflin.

Franchise Sold.—The Washington (Pa.) Electric Street Railway Company, which was composed of outside capitalists, has sold its franchise to local people. The gentlemen who have purchased the charter intend pushing the work at once, and will begin operations as soon as possible. The capital stock of the company is $60,00.

Kansas City, Mo.—The Detroit car (Rae system) that has been in operation on the Vine Street line in this city for the past few weeks has been pronounced a success by all who have ridden on it, and the management of the road are entirely pleased with the new device, though whether more will be ordered is not known, as the property has recently changed hands.

New Railway Line Opened.—The new Pittsburgh incline, which extends from South Twelfth street, Pittsburgh, to Mount Washington, and which will form an adjunct to the Birmingham Traction Company's electric line, has just been put in use. This incline is the largest in the city and best equipped. The engines are of the most approved kind and the car equipment is admirable.

New Electric Railway.—The Dravosburg, Mendelsohn & Elizabeth Electric Street Railway Company has been chartered at Harrisburgh, Pa., to operate a road seven miles in length. The capital of the company is $45,000, and is supplied by McKeesport people. The directors are James E. White, John Haben, Kohn K. Skelley, James L. Devenny and Joseph A. Skelley, all of McKeesport, Pa.

Pittsburgh, Pa.—The Squirrel Hill Railway Company, which ran out of funds some time ago, and was consequently placed in the hands of a receiver, will have its line completed in the near future. A few days ago the receiver asked permission of the court to borrow $5,000 for the work, and the petition was granted. This new line will open a large district of Pittsburgh which is devoid of rapid transit facilities.

Uniontown, Pa.—It seems that this town is now to have an electric street railway as well as Washington, Pa. Mr. A. D. Boyd and his associates have been given the privilege by the Council to "construct, maintain and operate a street railway, by electricity or other power," etc., on the various streets of Uniontown. Schemes are discussed and plans formulated in almost every citizen's mind as to the coming of the new enterprise, the operation of such a road, the construction of the cars, and the great business boom that is expected to follow. The company has not yet been fully organized, but when it is completed it will be composed entirely of local capitalists. It is said that work will be commenced on the tracklaying at the earliest possible moment.

The Pittsburgh Traction Company is making a good deal of money with its cable line between Pittsburgh and East Liberty. The Duquesne Traction Company, a newer corporation, is pushing with the utmost diligence its electric railway line which will for a considerable distance parallel the Pittsburgh Traction Company's system. Just now there is talk of war between the two organizations, the older company having expressed an intention to reduce its five cent fare to three cents upon the starting in business of its young rival. It is rumored that the Duquesne Traction Company has been negotiating for control of the Pittsburgh Traction; and also that the Pittsburgh Company has determined to buy the Duquesne Company. The lines of the Duquesne Company will reach a good stretch of territory which is without street car conveniences and conservative people think there will be plenty of business for both companies at the present rate of five cents.

MISCELLANEOUS NOTES.

A Slight Misunderstanding.—The Farmington (Maine) *Chronicle* has made the following surprising discovery: "A brute named Kemmler was tried, found guilty and sentenced to death and he was executed last week by electricity. It is hinted that private electrical companies, *whose apparatus was not used,* are responsible for much which has been said against this mode of executing criminals.'

Quotations on Electrical Stocks.—Mr. F. Z. Maguire Electrical Securities, of 18 Wall street, this city, reports the following quotations of Aug. 23 from New York, Boston, and Washington:

NEW YORK.

	Bid.		Bid.
W. U. Tel. Co.	82½	Edison Gen. Elec. Co.	102
American Tele. & Cable	83	Edison Gen. Co. Prf'd	90
Cent'l & So. Amer.	157	Consol'd Elec. Lt. Co.	60
Mexican	205	Edison Illn'g Co., N. Y.	....
Com. Cable Co.	....	U. S. Elec. Lt. Co.	35
Postal Tel. Cable	35		

BOSTON.

	Bid.		Bid.
Thomson-Houston	50¼	Ft. Wayne Co.	12
" Pre'd	25¼	Am. Bell	223
" Series C.	....	Erie	50¼
" " D.	6¼	New England	50
" Int. Co.	.....	Mexican	.85 c.
Thomson Welding Co.	....	Trop. American	.....
Thomson Eu. Welding	89	Edison Phon'gph Doll.	3¼
Westinghouse Electric	38		

WASHINGTON.

	Bid.		Bid.
Penna. Telephone	25	U. S. Electric Lt. (Wash.)	140
Ches. & Pot. Telephone	*75	Eck. & Sold. Home Elec.	
Amer. Graphophone	14	Ry.	68

* Ex. Dividend.

PERSONALS.

Mr. J. H. Vail has been appointed assistant engineer-in-chief of the Edison General Electric Company.

The Charles Munson Belting Co., of Chicago, has secured the services of Mr. F. W. Baugher in its sales department.

A Coming Wedding.—Cards are out announcing the coming marriage, on Sept. 3, at Boonville, N. Y., of Miss Jessica Tharratt to Frederic W. Best, of Denver, Col.

Industrial and Trade Notes.

The branch office of the Charles Munson Belting Co. of Chicago, at 44 Dey street, reports a rapidly increasing business under the management of Mr. E. Gabel.

The Fishkill Landing (New York) Machine Company is very busy for this season of the year. The company increase its facilities last spring by an addition to its works, which are use for erecting purposes.

The Joseph Dixon Crucible Company is applying its well-known and pushing business methods to the introduction of Dixon's traction belt dressing and leather preservative. Very flattering testimonials of its efficiency have recently been received from many of its users.

The Electricians' Time Company, Chicago, has met with a hearty reception from the electrical fraternity. Orders from every section are daily being received, not only for standard watches, but also for jewels and precious stones, and the entire business has proved profitable from the start.

Messrs. Gillinder & Sons, proprietors of the Franklin Flint Glass Works, the first to manufacture arc light globes in Philadelphia, are making an almost endless variety of globes and shades for gas, arc and incandescent lights, including various shapes, sizes and colors. Their patent silvered reflectors are meeting with great demand.

Alfred F. Moore, manufacturer of insulated electric wire and flexible cords and cables for electrical purposes, 200 and 202 North Third street and 301, 303 and 305 Race street, Philadelphia, Pa., has just issued a very neat little price-list, in which are given colored plates, showing the details of his wire coverings and also a number of valuable tables and data.

The Hazleton Tripod Boiler Company, of Chicago, is placing several of its large boilers in new electric light stations, where they have been adopted owing to the record for economy and efficiency established in other stations during the past few years. A prominent feature in the Hazleton boiler is the small amount of ground space required, a 300 h. p. requiring a circle of of but 13 feet in diameter, and a 500 h. p. but 17 feet.

The Chalmers-Spence Company, 59 and 61 Liberty street, New York City, reports business as being very good and the demand for its standard asbestos goods still on the increase. We notice that this firm is covering the steam pipes, cylinders, etc., of the engines and boilers being put in the new Fall River steamer "Plymouth," by the Wm. A. Fletcher Company, New York, with its patent fire felt (asbestos) covering, as well as the boilers themselves.

The Butler Hard Rubber Company 33 Mercer street, New York City, has secured the patents and inventions of Mr. William Kiel, which are said to possess the advantages of producing a rich black rubber throughout, with increased flexibility and lessened brittleness. The new processes are also said to be very economical, and in view of a reduction of price thus made possible the Butler Company has felt it necessary to build a large addition to its works.

A New Catalogue has been issued by the Chalmers-Spence Company, 59-61 Liberty street, New York City. It is well written and profusely illustrated, and presents the well-known asbestos goods made by this firm in an interesting manner. In a chapter on non-conducting coverings, the company says: "We were the first to produce a sectional covering composed solely of mineral fibres, and we are the inventors and sole patentees of the only strictly all asbestos covering in the market," Its patent fire felt pipe and boiler covering has become very popular.

The Excelsior Electric Company has good reports from its installation in St. Charles, Mo., where the owners speak in terms of the highest praise of the three 30-light arc Hochhausen dynamos recently furnished them. Twenty-five Hochhausen dynamos have been sold by the Excelsior Company in the last two months, and its western agent, Mr. H. Wadsworth, is meeting with much success in handling them, his latest order being (Aug. 20) for a 60-light arc machine.

Mr. William Marshall, University Building, New York City, has recently received orders from the Metropolitan Telephone Company, Columbia College, the N. T. & N. J. Telephone Company, the Brush Illuminating Company, the Long Distance Telephone Company, the East River and the Mount Morris Electric Light companies, and many others, for his electrical condensers, which, owing to their superiority of material and workmanship, are acknowledged to be standard instruments of their kind.

The Great Western Electric Supply Company has received a large invoice of telegraph apparatus, and the learners' outfits are already being rapidly disposed of. The company has several other large lots on the way and expects to control a large part of the Western business in telegraph apparatus. It is also selling large quantities of the Sanson batteries which have heretofore been better known in the East than in the West. The company's first catalogue, which is called a sketch catalogue, is expected out this week.

The Electrical Merchandise Company, Adams street, Chicago, expected to have its new catalogue ready in time for distribution at Cape May, but continued additions will prevent its appearance for ten days at least. It is gratifying to note that the increased amount of business that has naturally come to this company has already rendered imperative the renting of storage room for its heavy goods, and will probably necessitate other changes before long. The company was represented at Cape May by General Manager W. R. Mason.

The Sensible Packing Company, Chicago, is placing on the market its patented "World's Fair packing," which has several qualities that render it superior to much of the packing now in the market. It has an elastic core of cork, with the same covering as the Sensible Automatic Packing, and possesses all the elastic properties of a gum core with none of the disadvantages of the use of gum, so combined with the flax cover, wax and plumbago lubricant. It is not affected by acids or acid waters, and is particularly adapted for high speed engines, pumps and other machinery of like character used in an electric plant.

J. J. Ryan & Co., 68 to 74 West Monroe street, Chicago, now have the largest and most complete brass foundry in the West. With 32 furnaces they have a smelting capacity of 10,000 pounds of brass per day, accommodations for 40 moulders, occupying a floor space of 20,000 square feet, while their equipment is such as to enable them to produce all kinds of work, from the lightest casting possible to one weighing a ton. Using only new metals in the manufacture of their goods and employing only expert moulders, they thereby secure absolute uniformity, and a great saving in labor where castings are required to be finished. It is interesting to note in this connection that the contest for prizes offered by the Chicago *Morning News* for the "most expert moulders" in the craft in Chicago will take place in this foundry, the committee having asked that it be placed at their disposal for that occasion.

The Swain Metallic Packing.—This packing is said to successfully accomplish results attained by no other metallic appliance where steam or air is used. It is a combination of metal-wearing body consisting of rings made from three segments of anti-friction metal with expansion joints, surrounded by a fibrous cushion arranged in such a manner that the durability of the packing is greatly increased by obtaining the anti-friction qualities of metal, and the elasticity of fibre in combination on piston rods. By its construction a series of independent packings or rings is secured—each one a perfect packing in itself, so arranged as to allow a water-space of from 1/8 to 3/4 inch between each metal bearing. By the peculiar shape of the metal ring the fibre is enclosed in such a manner as to thoroughly protect it from the action of steam and water—thus retaining and protecting its elasticity under all conditions. This packing is placed on the market by the Swain-Goodsell Metallic Packing Company, 137 Lake street, Chicago.

Warren, Webster & Co., 491 North Third street, Philadelphia, Pa., have just issued an illustrated catalogue, with testimonials as to the merits and superiority of their "Vacuum" exhaust steam economizer, which they would be pleased to send to all inquiring parties. Webster's "Vacuum" exhaust steam economizer has just been adopted by the J. G. Brill Company, of Philadelphia, to utilize the exhaust steam for heating, and returning the condensation to the boiler in its new car shops. Webster's "Vacuum" economizer has also been adopted by the Pullman Palace Car Company, of Pullman, Ill., to feed the boilers with purified water at a high temperature. The economizer is of 700 h. p., and is said to have been accepted by the company after a competitive test, in competition with a standard make of pressure feed water heater. The Pullman Palace Car Company is so well pleased with its results that it has just ordered another Webster's "Vacuum" exhaust steam economizer of 1,500 h. p. The Union Depot Electric Railway Company, of St. Louis, Mo., has also just adopted a 600 h. p. Webster economizer, after a satisfactory test as to its merits.

The Indurated Fibre Pipe Company, of Mechanicville, N. Y., with offices in New York City, at No. 40 Wall Street, is entering the field of underground and interior conduit work, with a material for which very great merits are claimed. Its pipe is made by a patented paocess, from long wood fibres, separated, washed free from all saps and gums, moulded while in a pulpy state into the requisite size and shape and then subjected to great hydraulic pressure. It is then treated and hardened by a chemical process, which is said to render it strong, hard and impervious to acids and moisture, absolutely waterproof, proof against decay or corrosion, and practically indestructible. The pipe is supplied in lengths of five feet with sleeve couplings, bearing standard pipe thread, so cut that the ends "butt" in coupling—thus preventing any catch or pocket at the joints. Each length is carefully reamed out to a uniform diameter. The weight of the pipe is one-fifth that of iron and its tensile strength is over 1,000 pounds to the square inch while it is said to resist a temperature of over 200 degrees Fahr. The officers of the re-organized company are J. L. and Jonathan Brownell, and H. J. Medbury. Geo. A. Bowen is General Manager.

WANTED.

Armature Winder.—Siemens Armature Winder. State experience and reference. SCHUYLER ELECTRIC CO., Middletown, Conn.

Armature Winder.—At once, Experienced armature winder. Best of references required. COLUMBIA ELECTRIC CO., 207 E. Fourth street, St. Paul, Minn.

Salesman Wanted at once for Electrical supplies; only first-class men need apply. Northwest Thomson-Houston Electric Company, St. Paul, Minn.

Designs Wanted.—Designs for an accurate, reliable, simply constructed ammeter and voltmeter. Must be patentable. CHAS. P. LARNED, 61 Bulil Block, Detroit, Mich.

Draughtsmen Wanted. — Two first class draughtsmen familiar with electrical work. Address, stating experience and salary expected, THOMSON ELECTRIC WELDING CO., Lynn, Mass.

Lineman Wanted.—A Steady, Active American Lineman to do inside electric light work; one who has some knowledge of bell work preferred. State experience, etc. BERKSHIRE ELECTRIC CO., Pittsfield, Mass.

Department Manager Wanted.—Man to take charge of detail department of electrical factory. Must be a good mechanic and have had experience in managing men. Applications should state experience and salary expected. Address S. C., Care The Electrical World, New York.

Telephone Manager.—An Experienced Telephone man to take entire charge of a telephone exchange in operation in a tropical country. Good salary paid to a competent man. To obviate delay, state your experience in detail, present occupation, salary now receiving and reference. Address TROPICAL, Care The Electrical World, New York.

Electric Light Stock.—Investment Opportunity.—Person having $8,000 to $10,000 can find excellent opportunity to complete stock subscription to a local electric light company in a flourishing town of over 4,000 population in southern New England. Can secure management of enterprise which will bear closest scrutiny. Address AMPERE, Care The Electrical World, New York.

Machinist and Engineer, competent to take charge of our engines, boilers and dynamos. Address, stating experience and salary expected, BRUSH ELECTRIC LIGHT AND POWER CO., Savannah, Ga.

Branch Electrical Supply House.—A good opportunity for some electrical supply house to open a branch in Baltimore, Maryland. One who will furnish samples preferred. Good reference. Address SUPPLIES, care The Electrical World, New York.

Situation Wanted.—By a First Class mechanical and electrical engineer, a position where brains and energy are required. Address DYNAMIC, Care The Electrical World, New York.

Situation wanted as superintendent of central station, by one who has had large experience in line construction; understands arc and incandescent work. Have been handling men for several years. Can give the best of references. Address J. M., Care The Electrical World, New York.

Situation Wanted.—The advertiser, who has had practical experience in business department of electrical manufacturing, commercial lighting and electrical supplies—both in office and on the road—would like an engagement. Is a competent accountant and office manager—thoroughly posted od construction and the handling of men. Willing to go anywhere. Could enter upon duties at once. Address ENERGY, Care The Electrical World, New York.

FOR SALE.

United States Arc Dynamos.—5 50-light U. S. Arc Machines and 250 U. S. Double Carbon Arc Lamps, all in good repair and ready to operate. Address LITTLE, McDONALD & CO., 144 E. Seneca street, Buffalo, N. Y.

Porter-Allen High-Speed, Automatic Steam Engine, cylinder 9 in. diam., 16 in. stroke, 50 h. p. Used a short time in United States Mint. Condition equal to new. A bargain. FRANK TOOMEY, 131 North Third street, Philadelphia, Pa.

Dynamos and Lamps. Will be Sold Cheap.—Two 35-light American Dynamos, with regulators; one 25-light American Dynamo, with regulator, all in excellent condition; 58 single American Lamps; 128 double American Lamps. W. H. GORDON & CO., 115 Broadway, New York.

Electric Light Plant, capacity 600 incandescent lamps. Exclusive franchise and contract with city. Dynamos and engine in first-class order. ZEPH CHAS. FELT, Storm Lake, Iowa.

Interest in Electric Business.—Controlling interest in an Electrical business in New York, protected by patent having 17 years to run. $10,000, or upwards can find employment. Address H. B. K., 683 President St., Brooklyn, N. Y.

Dynamos and Motors.—One 400-light (16 c. p.), 110 volt dynamo. One 300-light (16 c. p.). 110 volt dynamo. Two 250-light (16 c. p.), 110 volt dynamos. One 200-light (16 c. p.), 110 volt dynamo. Two 50-light (16 c. p.), 110 volt dynamos. One 10-h. p., 220 volt motor. Two 5-h.p., 220 volt motors. Two 4-h. p., 220 volt motors. One 2-h. p., 220 volt motor. One 1-h. p., 220 volt motor. One 1-h. p., 110 volt motor. One 1/2-h. p., 110 volt motor. One 1/4-h. p., 110 volt motor. The above machines are all new and guaranteed strictly first class. For prices address V. J. MAYO, Rockford, Ill.

MAST ARMS.

The Best. The Cheapest.

Address J. J. RENEHAN,
116 Vine St., New Britain, Conn.

WOODBURY MAKE ENGINES AND BOILERS FOR SALE AT BARGAINS.

MEDIUM SPEED, AUTOMATIC TYPE.

One left hand, 55 horse power.
One right hand, 75 horse power.
One left hand, 75 horse power.

HIGH SPEED, AUTOMATIC TYPE.

One self-contained, centre crank, 140 horse power.
Two self-contained, centre crank, 18 horse power each.

SINGLE SLIDE VALVE, THROTTLING TYPE.

One right hand, 16 horse power.

HORIZONTAL TUBULAR BOILERS.

Four 12 horse power.
Two 16 horse power.
One 55 horse power.

ROCHESTER MANUFACTURING CO.,
254 Mill Street, Rochester, N. Y.

ARC.

One 50-light American dynamo, with regulator, and 50 single American lamps.
One 35-light American dynamo, with 35 Fuller-Wood single lamps.
Two 25-light Western electric dynamos, low tension with regulator, sliding base and 50 single, outside frame, lamps.
One 20-light American dynamo with 17 new style American single lamps.
One spare armature for 20-light American dynamo.
Two 20-light Sperry shunt wound low tension dynamos with single lamps.
Two 20-light U. S. shunt wound low tension dynamos, with rheostat and sliding base.
One 16-light Brush dynamo with 16 single lamps.
Two 10-light U. S. low tension shunt wound dynamos.
One 10-light U. S. low tension series wound 12-pole dynamo.
One 10-light Excelsior dynamo with 10 single lamps.
One 6-light Van De poele dynamo, low tension, with six single lamds.

INCANDESCENT.

One 700-light shunt wound dynamo, 100 volts, 37 ampères.
One 450-light Edison dynamo, 220 volts.
Two 300-light U. S. shunt wound dynamos 70 volts.
One 200-light old style Edison dynamo, 11 Volts.
Two 200 light U. S. long distance shunt wound dynamos, 560 volts.
Two 200-light U. S. long distance shunt wound dynamos, 500 volts.
One 150-light U. S. shunt wound dynamo, 70 volts.
Two 100-light U. S. shunt wound dynamos, long distance, 280 volts.

SPECIAL.

Two 25-light Excelsior armatures, new.
One 20-light American armature.
Thirty new style single U. S. lamps.
Twenty new style double U. S. lamps.
Forty old style single U. S. lamps at $5.

ROSE ELECTRIC LIGHT SUPPLY CO.,
1,106 Pine Street, St. Louis, Mo.

PROPOSALS.

Notice to Electric Light Contractors.

Office of the Clerk of the Village of Cambridge, Ohio.

Sealed proposals will be received at this office until Saturday, Sept. 20, 1890, at 12 o'clock M. for lighting the streets of said village with electricity for a term of five years, according to specifications on file in this office.

The right to reject any or all bids is reserved.

Proposals must be sealed and endorsed "Bids for Lighting the Streets of Cambridge, Ohio."

John S. Black,
Village Clerk.

PROPOSALS.

Tenders will be received at the City Engineer's Office, London, Canada (where plans and specifications may be seen), up to Thursday, Sept. 4, for an electrical plant complete capable of lighting the city; also, tenders for lighting the city for a term of five years.

Lowest or any tender not necessarily accepted.

THOS. H. TRACY, City Engineer.
Ald. JOHN BOYD, Ch. No. 3 Council.

TENDERS

For Lighting the Streets of the City of Toronto.

Tenders addressed to the undersigned will be received by registered post up to 12 o'clock noon of TUESDAY, SEPTEMBER 2d, 1890, for the Lighting of the Streets, Avenues, Squares and Lanes of the City of Toronto with Electric Light, Gas Light, or both, for a period of two, three and five years from the first of January, 1891.

Specifications and forms of tender can be obtained upon application at the office of the Secretary of the Fire Department, corner of Bay and Temperance streets, Toronto.

A cash deposit or marked cheque, made payable to the order of the City Treasurer, for the sum of three thousand dollars ($3,000), must accompany each and every tender, together with the *bona fide* signatures of two responsible persons, who will become sureties for the due fulfillment of the contract. The deposit accompanying the tender will be forfeited to the city in the event of the person or persons whose tender is accepted failing to execute the necessary contract or give satisfactory sureties for the due fulfillment of the same. Deposits of unsuccessful tenderers will be returned.

The lowest or any tender not necessarily accepted.

WILLIAM BELL,
Chairman Committee Fire and Light.

City Clerk's Office, Toronto, Aug. 8, 1890.

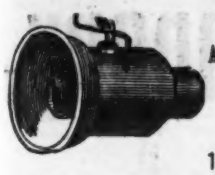
DYNAMO CASTINGS.

Neatly and symmetrically designed Castings for small dynamos and motors. Practical and easy of construction.

G. RENNERFELT,
Mattapoisett, Mass.

$400, MEDIA (PA.) MILITARY ACADEMY: boys. Brooke Hall: girls. Circulars free.

SPEAKING TUBES



ALL STYLES OF
Alarm Whistles, Bell Tubing
Elbows in every size and variety.
Electrical Supplies.
Owen Walsh, Mfr.,
105 Walker St., N. Y.

Cut shown without lid

Dr. Jerome Kidder's superior Electro-Medical Apparatus.

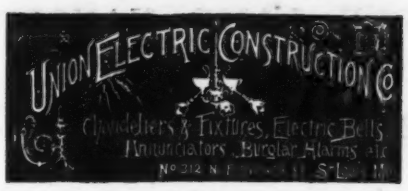
For Physicians, Surgeons and Family Use. Send for a catalogue and mention THE ELECTRICAL WORLD, **Jerome Kidder Mfg. Co., 820 Broadway, New York.**

JAMES T. LAVIN ESQ.

COUNSELLOR AT LAW.

Special Practitioner in matters of Electricity. Electrical Patents Procured, Contested and Validity of Inquired into.

Room 41, 7 EXCHANGE PLACE,
BOSTON, MASS.



BATTERY ZINCS.

(Established 1855.)

EDWIN L. EDES,

SUCCESSOR TO

OLIVER EDES & SON, Plymouth, Mass.,

Manufacturers of

Crowfoot Zincs.	Zinc Nails, etc., etc.
Rolled Leclanche Zincs.	Copper Tacks.
Zinc Cups (for Dry Batteries).	Copper Nails.
Fire and Burglar Alarm Zincs.	Copper Boat Nails.
All Shapes of Cast and Rolled Zincs to order.	Copper Spikes.
Battery Coppers.	Copper Sheathing Nails.
Zinc Nail Plate.	Copper Slating Nails.
	Copper Shoe Nails.
	Copper Burrs.

We are large owners in the Edes, Mixter & Heald Zinc Company's mines and works in Tennessee, and have our own water power and rolling mills here.

Our zinc is purer and superior to ordinary zinc, and is giving the best of satisfaction for fire-alarm and other particular kinds of service. We have every facility for making the lowest prices, quality considered, for all kinds of battery zincs.

Please send for prices (for any quantity) for what you want.

ALUMINUM, $2 PER POUND.

The Pittsburgh Reduction Company, 95 Fifth avenue, Pittsburgh, Pa., U. S. A., offer commercially pure aluminum at the following rates at Pittsburgh, Pa.:

Lots of 1,000 lbs. and over....$2.00 ₱ lb.
Lots of 500 lbs. and over.....2.25 ₱ lb.
Lots of 100 lbs. and over.....2.50 ₱ lb.

Metal guaranteed to be equal in quality to the best metal manufactured by any other process.

Prices on sheets, wire, tubes or castings given upon application.

UNEQUALLED. SOLD OUTRIGHT.

BENNETT TELEPHONES

FOR SHORT PRIVATE LINES.

NATIONAL TELEPHONE MFG. CO., 620 ATLANTIC AVE., BOSTON, MASS

CLARK ARC SYSTEM

SEND FOR CATALOGUE B.

Is the Cheapest and Most Economical in the United States.

Manufactured by The CLARK ELECTRIC CO., 192 Broadway, New York.

THE SUNBEAM MAINTAINS ITS RATED CANDLE POWER

QUALITY OF LIGHT, THE PERFECTION OF BEAUTY.

SEND FOR PRICE-LIST.

The Sunbeam Incandescent Lamp Co., cor. Randolph & Canal Sts., Chicago.

Bonnell's Nubian Iron Enamel.

The Best Coating for Arc Lamps, Hoods, Towers, etc.,

And all work which needs protection from weather. It will also render wooden moldings and conduits impervious to moisture. It is absolutely odorless.

SATISFACTION GUARANTEED OR MONEY REFUNDED.

THE NUBIAN IRON ENAMEL CO.,

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STANDARD THERMOMETER CO.,

ELECTRICAL

INDICATING AND RECORDING INSTRUMENTS,

For Electric Light and Power Stations, Steam Plants, Water-works, Kilns, Ovens, and Kettles, Cold Storage Warehouses, etc.

Continuously indicating and recording at one or more distant points changes of Temperature, Steam, Water or Gas Pressure, Height of Water. Dial Thermometers for all purposes. Catalogues on application.

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LEADS ALL

RUBBER COVERED WIRES.

Electric Light and Railway Supplies.

ILLINOIS ELECTRIC MATERIAL COMPANY, 341 ROOKERY CHICAGO.

HENRY C. EDDY,

Manufacturer's Agent,

Electrical Supplies and Specialties

ROOM 22, 170 LA SALLE ST.,
CHICAGO.

STEVENS PATENT
RELIABLE DIVIDER. No. 61
With Thumb Attachments.
Forged from heavy stock, operated with a right and left hand screw. Made with two tension screws, removing any back lash.
5 inches, price per pair.....$1.75
Ideal and Leader Spring Dividers and Calipers, Ideal Surface Gauges, Depth Gauges, and Fine Machinists' Tools.
☞ *Illustrated catalogue free to all.*
J. STEVENS ARMS & TOOL CO.,
P. O. Box 287 Chicopee Falls, Mass.

Do you use
THE LAW BATTERY?
If not, why not?

The Cheapest Battery and the Best.
LAW TELEPHONE CO.,
85 John St., New York.

RUBBER TAPE.

ANDOVER, Mass., June 25, '90.

ELECTRICAL SUPPLY COMPANIES:

GENTLEMEN: Being large manufacturers of pure Gum Rubber Tape and Tubing, we should be pleased to send you samples and quote prices on the same.

Estimates made on all kinds of mould work in soft rubber goods. We solicit trial. Yours respectfully,

TYER RUBBER COMPANY.

TUBING.

Corliss Engines

Of the highest type, in all sizes, are made by

The Lane & Bodley Co.

CINCINNATI, O.

The merits of their engines are described in an illustrated pamphlet, which will be sent to any one interested.

STANDARD ELECTRICAL TEST INSTRUMENTS.

AMMETERS AND VOLTMETERS

For Direct and Alternating Currents.

Queen's Standard Resistance Boxes and Wheatstone Bridges wound with Platinoid Wire. Outfits for Insulation Tests.

Queen's New Portable Combination Testing Set, with Galvanometer. Cheap and Accurate.

We have Special Facilities for Recalibrating Ammeters and Voltmeters.
Send for Catalogue I 66 of Electrical Test Instruments.

QUEEN & CO., Philadelphia.

THE "CLARK" WIRE.

Insulation Guaranteed wherever Used, Aerial, Underground or Submarine.

In a letter from the INSPECTOR of the **Boston Fire Underwriters' Union,** under date of March 29, 1886, he says: **"A Thoroughly Reliable and Desirable Wire in every respect."**

The rubber used in insulating our wires and cables is especially chemically prepared, and *is guaranteed to be waterproof*, and *will not deteriorate, oxidize* or *crack*, and will remain flexible in extreme cold weather, and is not affected by heat. The insulation is protected from mechanical injury by one or more braids, and the whole slicked with Clark's Patent Compound, which is water, oil, acid, and to a very great extent fireproof. *Our insulation will prove durable when all others fail.* We are prepared to furnish Single Wires of all gauges and diameter of insulation for Telegraph and Electric Lights from stock. Cables made to order.

We are now prepared to furnish our Clark Wire with a *White Outside Finish* for ceiling cleat work as well as our standard color.

CLARK JOINT GUM should be used for making water-proof joints. This is put up in half-pound boxes, in strips about one foot long and five-eighths inch wide, and when wrapped about a joint and pressed firmly it makes a solid mass.

FOR RAILWAY AND MOTOR use, we make all sizes of stranded and flexible cable with Clark insulation. Wire Tables and price list will be furnished on application to

EASTERN ELECTRIC CABLE COMPANY,

61 to 65 Hampshire Street, Boston, Mass.

HENRY A. CLARK, General Manager. HERBERT H. EUSTIS, Electrician.

A. A. McCREARY, Vice-President and General Manager. C. C. FOSTER, Secretary and Treasurer.

The McCreary Electrical Specialty Company,

SUCCESSOR TO A. A. McCREARY,

Office and Sample Room, 18 Cortlandt Street, New York,

MANUFACTURERS OF

McCreary's Silvered Glass Reflector Shades,
McCreary's Glass Revolvable Half Shade and Reflectors,
McCreary's Electric Light Shield,
McCreary's Mica Dust Protectors,
McCreary's Frictional Pendant Block and Socket Protector,
Lancaster Arc and Incandescent Switch,
Special Brass Portable for McCreary's Reflectors.

WE ARE SOLE AGENTS FOR

THE BRADNER ADJUSTABLE LAMP HANGER

For the Eastern, Middle and Southern States.

Selling Agents for Patented Flexible Brass Chain, Patented Wrought Brass Shade Ho'ders.

TO INVENTORS.

We have unsurpassed facilities for placing upon the market Patented Electrical Specialties of MERIT either on Royalties or by purchase of exclusive right to manufacture and sell the same.

New and Complete Illustrated Catalogue ready September 1st.

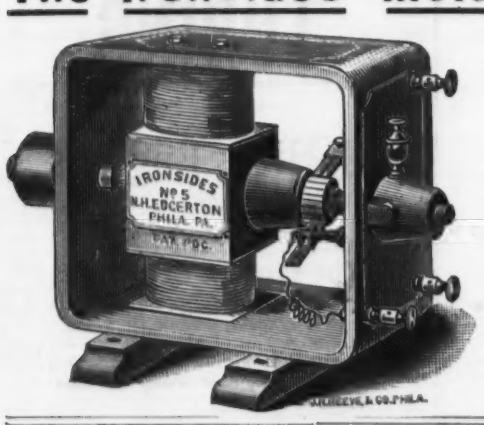
ADDRESS AS ABOVE

The McCREARY ELECTRICAL SPECIALTY CO., 18 Cortlandt St, N. Y.

INCANDESCENT WIRING TABLES

And Other Useful Information for Linemen.
By CHARLES M. DAVIS.
POCKET EDITION. PRICE, 75 CENTS.
Address, THE W. J. JOHNSTON CO., Ld., Times Building, New York.

The Ironsides Motors and Dynamos



MANUFACTURED BY

The Electrical Construction and Improvement Company,

805 SANSOM STREET,
PHILADELPHIA.

This Motor commends itself to the public on the following grounds:

1st. Its Small First Cost.
2d. Its Small Cost for Maintenance.
3d. Its Great Simplicity.
4th. Its Great Efficiency.

HARD RUBBER.

ALL KINDS OF HARD RUBBER GOODS MADE TO ORDER.
HARD RUBBER BATTERY CELLS AND ELECTRICAL WORK A SPECIALTY.
M. C. CHASE, 80 Market St., CHICAGO.

The American Circular Loom Co.,

SOLE MANUFACTURERS OF

Patent-Woven Insulated Wires

The Highest Abrasion-Resistance and Tensile Strength Wire in the Market.

WESTERN AGENTS:

THE ILLINOIS ELECTRIC MATERIAL COMPANY.

CHICAGO, ILL.

BOSTON, MASS. - - - 620 ATLANTIC AVE.

THE GREAT DYNAMO BELT

—IS THE—

UNDERWOOD PATENT COTTON-LEATHER BELT,

Used in over 100 Electric Light Stations, and on Every Known System,

THIS BELTING POSSESSES FOUR VERY IMPORTANT POINTS OF MERIT.

FIRST.—This belt is practically without stretch. Every part of it is thoroughly tested and the stretch taken out by being run upon pulleys at our factory.

SECOND.—The belt runs perfectly straight upon the pulleys. This is perhaps the most essentia quality that should be found in an electric light belt, because, as the belting runs at a high rate of speed the lateral motion imparted to the armature shaft by a crooked running belt is constantly wearing the bearings, and the belt is an unsightly object.

THIRD.—The belt is perfectly balanced, all the parts are of uniform texture and equal weight, enabling it to be run at high rate of speed without the swaying motion which a leather belt has imparted to it, by reason of its being constructed of a material lacking that uniformity of properties necessary to the construction of a well balanced belt.

FOURTH.—This belt has the most perfect contact attainable between the face of the pulley and the belt, as it is of a soft, even, pliable texture, and can be run with less strain upon it than any other style of belting without slipping, and consequently with less friction upon bearings of engines and dynamo.

THESE CLAIMS are well supported by recent tests made by SAMUEL WEBBER, Esq., C. E. extending over a period of SIX weeks. These tests were comparative ones between nearly all the different belts now made and sold to the public, and a copy will be furnished to all applicants.

THE UNDERWOOD MANUFACTURING CO

TOLLAND, CONN.

An Interesting Talk

ON

LEATHER BELTING

AT AN

ELECTRIC LIGHT STATION.

VISITOR: Have you got any of those new belts in your station with holes all over the belt?

ENGINEER: You mean those perforated leather belts? Yes; over there is one running.

VISITOR: Are they good for anything?

ENGINEER: Well, when that belt arrived here, we all laughed and scorned the idea of a belt full of holes to do our work, and that it would do it better than the other belts.

VISITOR: Did you give the belt a trial?

ENGINEER: Yes, we put it on that dynamo when almost every belt had failed, because the belt travels at a speed of about 8,000 feet per minute, which is a severe test on any belt. Of course, we expected the perforated to back down at the very start, but if you step over here you can see for yourself how well the belt is running.

VISITOR: How long has the belt been running on that dynamo?

ENGINEER: I think it is about a year now.

VISITOR: Do you consider that a pretty good test for a belt that runs at such a tremendous speed?

ENGINEER: Yes, to be sure; and what is more, that belt has hardly stretched any since it has been put on, and runs as easy as anything. To look at it, you would say it stands still.

VISITOR: How do you account for that?

ENGINEER: Well, I often sat down and watched that belt running, and I am satisfied that those perforations completely break the air current that travels with the belt. Why, I can almost lay my hand on the belt running at full speed, and I would not dare to come within a foot of any other belt running at that speed for fear of being caught up with the strong current of air that travels along with the belt.

VISITOR: But the belt seems to be awful loose and slack?

ENGINEER: So it is! That is another beauty of that belt; although running so loose, it doesn't slip a bit, and is very easy on the bearings. I have no bother with heating on this dynamo; the belt runs smoothly and steadily, and, you notice, does not make any noise, like other belts, nor does it flap and jump, but simply lies on the pulleys and runs along.

VISITOR: Well, from what you say, you consider the perforated belt the best of all?

ENGINEER: Indeed, I do; and if I had the buying of belts for this plant, I would take nothing else, and would punch holes in all the belts that are in this plant; but somebody told me that the idea was patented, and I might get myself into trouble if I punched them, so I leave it alone until I get orders; but it would be money in the company's pocket if they had all the belts perforated.

The visitor, after a few remarks, retired, and thanked the engineer for his frank opinion upon an invention which has drawn such universal attention and favorable comment by prominent electricians and engineers.

The electric light station visited was one of the largest in this country, and the engineer had no idea that he was interviewed by the originator and inventor of perforated leather belting; therefore his open and evidently sincere testimony was greatly appreciated. It also gave another proof that the purchasing of supplies is not always left in the hands of competent and practical men; and, as a rule, too much attention is paid to price, rather than quality and merits of the goods.

PATENT PERFORATED ELECTRIC LEATHER BELTING

IS MANUFACTURED BY

CHAS. A. SCHIEREN & CO.,

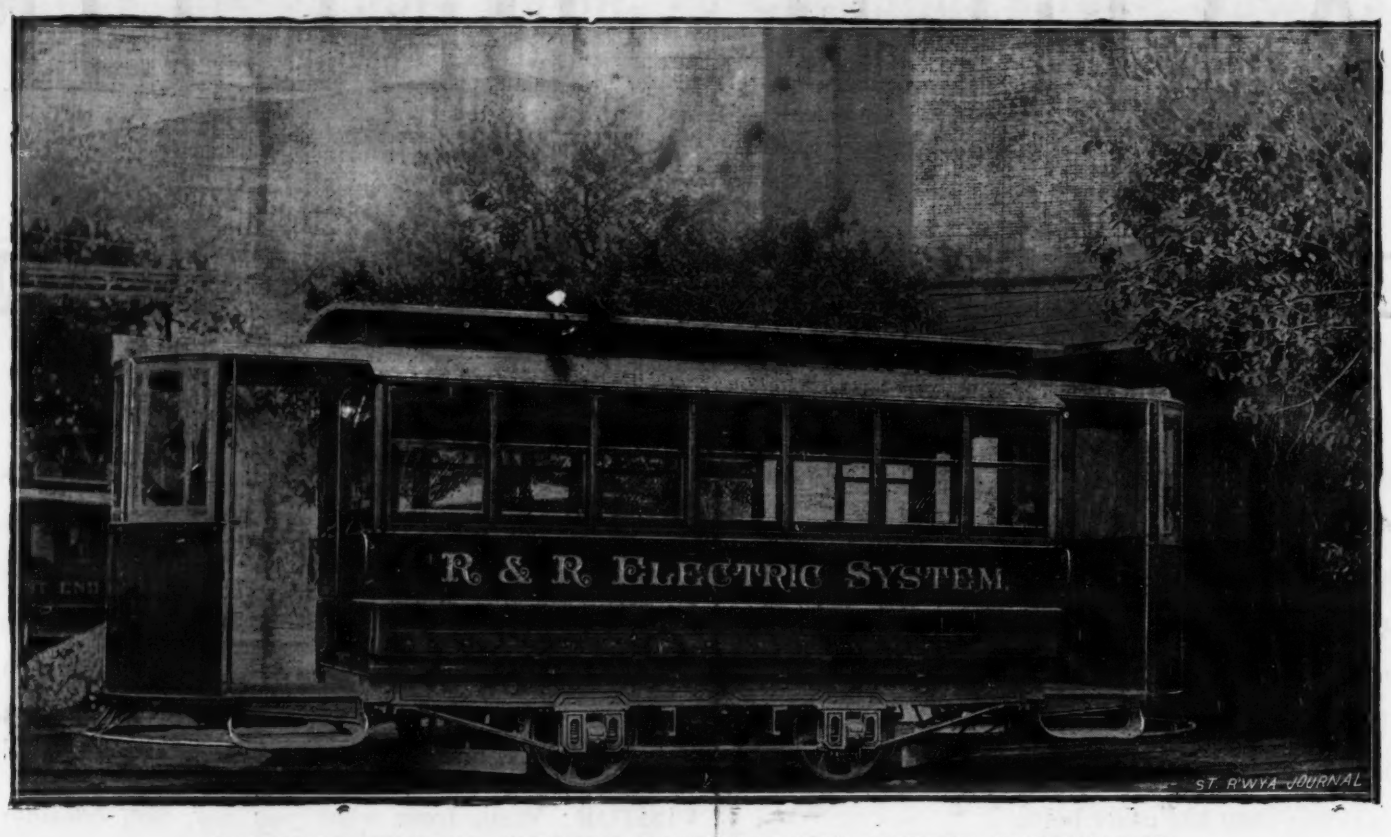
47 Ferry Street, New York.

CHICAGO. PHILADELPHIA. BOSTON.

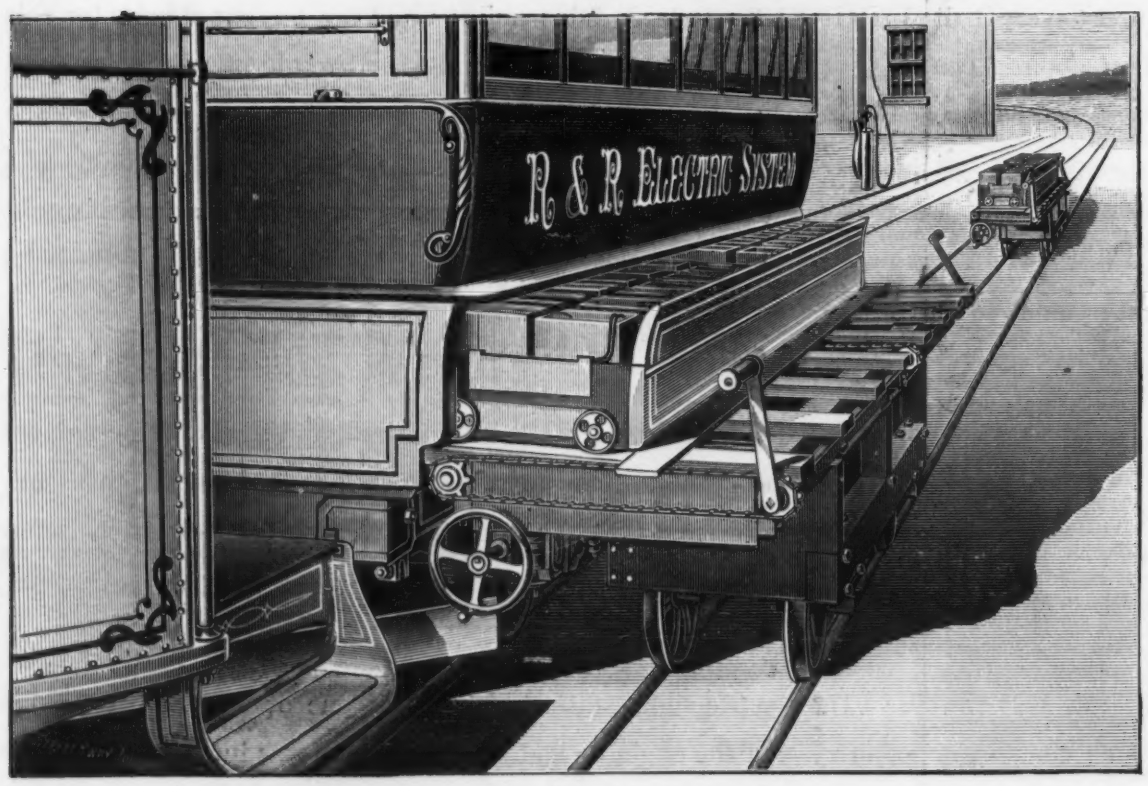
GEO. L. WRIGHT, Prest. and Gen. Man. ALBON MAN, Vice-Pres. F. F. RANDOLPH, Sec. and Treas. WM. MAIN, Electrical Engineer.

RIVER & RAIL ELECTRIC LIGHT COMPANY,

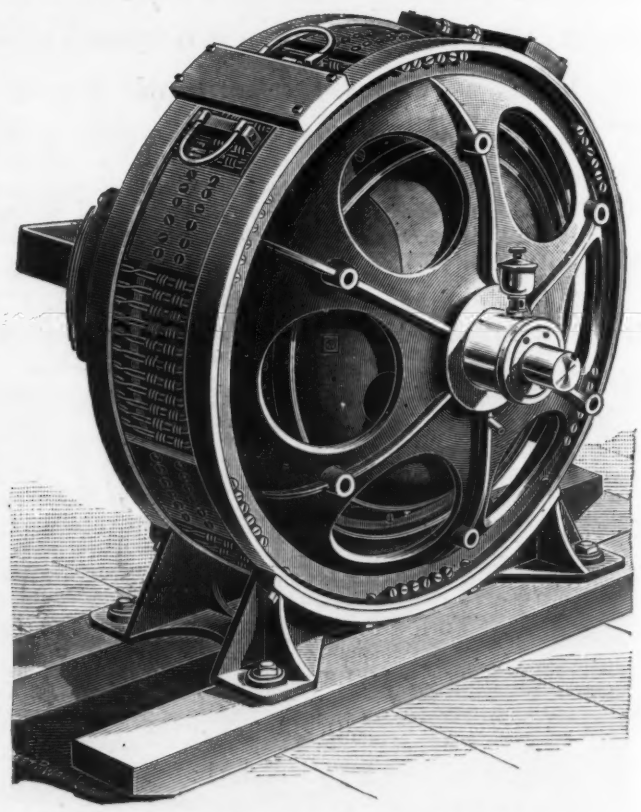
ALDRICH COURT, 45 BROADWAY, N. Y.



THE RIVER AND RAIL ELECTRIC COMPANY'S NEW STORAGE BATTERY CAR.



METHOD OF CHANGING BATTERIES IN THE RIVER AND RAIL SYSTEM.



THE RIVER AND RAIL MOTOR.

THE MAIN ELECTRIC MOTOR

Owned by this company differs both in appearance and principle from those of the common type, much as the turbine water-wheel does from others.

The lines of force take the form of a vortex or whirlpool. No wire is in motion, and the moving part is in the form of a smooth disc. A larger output of power in proportion to weight with fewer revolutions per minute is the result of this construction.

THE MAIN STORAGE BATTERY

Has no applied oxides or compounds of lead, either as paste or powder. The positive electrode is formed by the action of the current alone. The Mechanical Construction is such as to secure unusual durability with a capacity several times that of the old Planté battery, and in excess of any of the usual "grid" batteries.

The negative electrode contains no lead, is lighter than electrodes of spongy lead, and gives higher electromotive force. The battery is adapted to withstand high rates of discharge and rough treatment.

THE CAR MACHINERY

Allows the coupling of both axles to a single motor without the hard running action heretofore the result of this construction. It enables a motor of moderate weight to start and handle a car under severe conditions of grade and curve without wasteful or dangerous demand upon the batteries.

It allows the motor to revolve under its most favorable conditions, while the speed of the car and power consumed may vary widely.

This is done without electric resistance or shifting battery connections.

It does **not** belong to the numerous family of "car starters." The mechanism is quiet in action and durable.

CARS ARE LIGHTED BY BATTERIES THAT PROPEL THE MOTOR.

STREET CAR COMPANIES and ELECTRIC RAILWAY CORPORATIONS SHOULD INVESTIGATE THIS SYSTEM.